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ABSTRACT

Recent research findings on the economic implications of investments in the quality of education are examined in this report. "The Quality of Education and Economic Growth: A Review of Literature" (Lewis C. Solmon) reviews evidence on ways to develop educational policy that would stimulate economic growth in developing countries. "School Quality and Economic Growth in Mexico" (Bruce Fuller, Kathleen Gorman and John Edwards) directly assesses the contributions of education to early agricultural and industrial growth in Mexico between 1880 and 1945. "The Stages of Growth in Educational Systems" (C.E. Beeby) examines the nature of change in education systems (stages of growth, qualitative changes in the classroom, and external constraints of changes) and the conditions necessary for this change. Finally, the reports on eight operational sessions--the administration of school systems, examination and selection policies, promotion and retention practices, teacher training, time on task, prevocational subjects, production and distribution of textbooks, and electronic media--are summarized under the title "Lessons from Bank Experience". A bibliography of World Bank research on the quality of education in developing countries is included. (SY)

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The Quality of Education and Economic Development

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edited by
Stephen P. Heyneman
Daphne Siev White

A World Bank Symposium

SO 017 558

The Quality of Education and Economic Development

edited by
Stephen P. Heyneman
Daphne Siev White

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Washington, D.C., U.S.A.

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Foreword

The issue of quality in the educational systems of developing countries is a relatively recent one, and not much has been written on the subject. For many years most of the emphasis was on growth and on the need to provide more schools and more classrooms for students in these countries.

As these school systems have grown, however, attention has been shifting toward the quality and value of the education being received. The papers in this volume are some of the first to address this topic. Two types of studies are presented here: the first relates to the economic growth that might result from expenditures on the quality of education; the second concerns the best way to implement changes intended to improve the quality of education. The papers were originally prepared for a conference on school quality sponsored by the World Bank's Research Committee and held in Harpers Ferry, West Virginia, in May 1983.

The World Bank has been assisting developing countries in the field of education for more than twenty years. During that time 284 projects costing more than US$12.1 billion have been approved for support with Bank loans and IDA credits in more than ninety countries. This assistance has helped to create more than 2.6 million new student trainee places in approximately 21,000 educational institutions: 185 universities, 651 teacher training colleges, 2,903 secondary schools, and 18,000 primary schools.

The effect of this experience has not been confined to the developing countries, however. The Bank's operational concept of the education sector has grown and, perhaps more significantly, has diversified. In the beginning the Bank emphasized quantitative targets in secondary and technical education. But gradually it recognized that the efficiency of transmitting technical and vocational skills depended on the quality of prior basic education, that the quality of facilities was as important as quantitative targets, and that the quality of education required the same capital investment and managerial attention as did the quantity of education.

Since 1963 the Bank has supported projects for teacher training, curriculum development, mass media education, research and evaluation institutes, and examination systems—areas that were hardly considered potential investments when the sector was inaugurated. Early projects supported the construction of schools, but more recent projects also support the equipping of schools. For example, 40 percent of the Bank's education projects now contain textbook components.

The seminar described in this volume was designed to take stock of two things: the recent research on the economic implications of investments in the quality of education and the operational experience acquired as a concomitant of this investment. The Economic Development Institute (EDI) is helping to disseminate these results to create a more informed and informal dialogue. This is one of a series of symposium publications designed to help officials in developing countries and Bank staff keep up to date on each other's current thinking.

Christopher R. Willoughby
Director
Economic Development Institute
Operations Policy Staff

Aklilu Habte
Director
Education and Training Department
Operations Policy Staff

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Contributors

C. E. Beeby helped to found the United Nations Educational Scientific and Cultural Organization (UNESCO). He is currently at the New Zealand Council for Educational Research.

John Edwards is an assistant professor of economics at Tulane University in New Orleans.

Bruce Fuller is a member of the Graduate Faculty of the University of Maryland and a researcher at the World Bank.

Kathleen Gorman is a Ph.D. candidate in education at the University of Maryland.

Stephen P. Heyneman is chief of the Education and Training Design Division in the Economic Development Institute of the World Bank.

Lewis C. Solmon, an economist, is a professor and associate dean in the Graduate School of Education at the University of California at Los Angeles.

Daphne Siev White is an educational writer and a consultant to the World Bank.

Other Participants

The World Bank

Albert Aime, general educator/planner, Education Division, Eastern and Southern Africa Regional Office.

Gunnar Berlin, educator, resident representative, Nairobi, Kenya.

Victor Billeh, general educator, Education Division, East Asia and Pacific Regional Office.

Aurelio Cespedes, general educator, Education Division, Latin America and the Caribbean Regional Office.

Hon-Chan Chai, general educator, Education Division, Eastern Asia and Pacific Regional Office.

Mae Chu Chang, formerly consultant, Education and Training Department, Operations Policy Staff.

Richard Durstine, general educator, Education Division, Eastern and Southern Africa Regional Office.

Frank Farner, general educator, Education Division, East Asia and Pacific Regional Office.

Birger Fredriksen, educational planner, Education Division, Western Africa Regional Office.

Shigenari Futagami, mass media specialist, Education and Training Department.

Ralph Harbison, operations advisor, Education and Training Department, Operations Policy Staff.

Mats Hultin, formerly senior advisor, Education Division, East Asia and Pacific Regional Office.

Dean Jamison, chief, Education Policy Division, Education and Training Division, Operations Policy Staff.

Richard Johanson, senior adviser, Education and Training Department, Operations Policy Staff.

Douglas Keare, chief, Education Division, Latin America and the Caribbean Regional Office.

Sherry Keith, educator, Education Division, Latin America and the Caribbean Regional Office.

William Loxley, formerly consultant, Education and Training Department, Operations Policy Staff.

Himelda Martinez, general educator, Education Division, Latin America and the Caribbean Regional Office.

James McCabe, general educator, Education Division, Eastern and Southern Africa Regional Office.

Robert McMeekin, economist, Education and Training Design Division, Economic Development Institute.

Abdun Noor, educator, Education and Training Department, Operations Policy Staff.

Delia Pitts, formerly economist, Education Division, Western Africa Regional Office.

George Psacharopoulos, manager, Research Program Unit, Education and Training Department, Operations Policy Staff.

André Salmon, general educator, Education Division, East Asia and Pacific Regional Office.

Barbara Searle, general educator, Education Division, East Asia and Pacific Regional Office.

Lennart Swahn, training adviser, Education and Training Department, Operations Policy Staff.

Eric Swanson, consultant, Development Research Department, Economics and Research Staff.

Jee-Peng Tan, economist, Education and Training Department, Operations Policy Staff.

Hans Thias, economist, Education Division, Western Africa Regional Office.

Jacob Van Lutsenburg Maas, sociologist/educator, Education Division, East Asia and Pacific Regional Office.

Mulugeta Wodajo, general educator, Education Division, Western Africa Regional Office

Laurence Wolff, general educator/planner, Education Division, Eastern and Southern Africa Regional Office.

Abdelwahed Zhiri, general education specialist, Education and Manpower Development Division, Europe, Middle East, and North Africa Regional Office.

Consultants

Philip Altbach, professor of Education, State University of New York at Buffalo.

Henry Levin, professor of Education and Economics, Stanford University (California).

Benjamin Makau, fellow at the Institute of Development Studies, University of Nairobi.

Anthony Somerset, lecturer, Institute of Development Studies, University of Sussex.

The Quality of Education and Economic Development

1

Overview

Stephen P. Heyneman

Twenty years ago the issue of quality in education was regarded as delicate and politically sensitive. Curricula were thought to be culture-specific, and national authorities were concerned first with localizing educational objectives and purposes. But the experiences gained in two decades of reform and intervention experiments have led both national and international authorities toward the view that, although cultural differences remain, the quality of education can—and indeed should—be subjected to technical scrutiny.

There are several reasons for this. Many educational objectives are the same from school district to school district and from country to country. For example elementary mathematics taught in the fourth grade in Nicaragua overlap considerably with the mathematics skills taught at the same grade in Thailand although the colonial history, culture, and governments of the two countries are entirely different. Similarly technical skills in agricultural engineering taught in Bangladesh are similar to those taught in other countries in Asia, as well as in Latin America, and in the Middle East, particularly where agricultural cropping is similar. This being the case, it is possible for education officials to ask whether students in their school system are able to master skills as well as students in a neighboring system.

It is also recognized that there are some common problems the world over, particularly management problems concerning "inputs" to school quality. Although classroom pedagogical style may be locally determined, the ingredients required to make classrooms function properly are not. Teachers need to be trained, paid, and supervised; reading materials, newsletters, and reference books need to be provided for each subject; curriculum objectives require constant technical review; and students with special needs must be identified and assisted.

And so during the past twenty years it has become clear that much (although by no means all) of the educational process is universal rather than culture-specific. An educational system, for example, is frequently the nation's largest employer: it typically accounts for an average of 15 percent of a nation's resources, 25 percent to 30 percent of public sector employees, and on any given day it directly involves a substantial portion of a nation's population. Thus the efficient delivery of educational services is much more than a local problem: it is a national and even an international issue.

Indeed the demand for international capital to improve the quality of education has risen markedly in the past decade. Previously most educational loans from the World Bank were directed at expanding educational systems by building more schools, hiring more teachers, and providing access for more students. Yet experience with this growth showed that merely building schools and adding teachers without providing them with textbooks, classroom materials, or proper teacher training does not bring about the desired changes in educational achievement.

This realization is reflected in recent Bank lending. Although none of the thirty-one World Bank education projects appraised between 1963 and 1969 contained a specific component for classroom materials, since 1976 one in five projects has included significant funding for electronic print classroom materials. One out of every two projects, moreover, has included funding for preservice training. This does not imply that developing countries are less concerned with expanding education; what it does imply is that, in addition, they are now

giving more attention to the problems of financing educational quality.

The Bank has been sponsoring research on the quality of education in developing countries through three projects. One concerns the economics of educational radio, one is about textbook availability and educational quality, and the last one deals with school quality and educational outcomes. The first two projects, both of which were started in 1977, have attempted to measure the effect of textbooks and radio, respectively, on student learning, attendance, and internal efficiency of student progression. The third project is an attempt to measure the effect of improving the full range of educational inputs: textbooks, teacher training, supervision and management, salaries, and classroom physical conditions. Bank staff have also summarized findings from the published literature and investigated trends across studies. Such reviews have been conducted on teacher training, class size, promotion and repetition policies, and the contribution of educational attainment to economic growth and agricultural output.

But two types of issues have thus far remained relatively unexamined. One is the economic yield to be anticipated from an investment in educational quality (as opposed to expansion), and the second is the degree to which such investments can be effectively implemented. These two issues were the main topics of discussion at a seminar, "The Quality of Education in Developing Countries," held at Harpers Ferry, West Virginia, in May 1983. This seminar was sponsored by the Research Committee through RPO 673-10. The papers in this volume stem for the most part from that forum. The seminar was attended by thirty-five Bank staff members with expertise in the different countries and regions involved in Bank lending, as well as staff from the policy and research departments. Education experts from outside the Bank also participated in the sessions.

Educational Quality and Economic Growth

The time lag between school attendance and economic activity, as well as variables such as home background, general ability, and shifts in the economy, make it difficult to isolate the effect of education on economic production. Accounting for quality factors within education makes the matter even more complex. Nevertheless it is important to try to measure the effects of investments in educational quality on economic production.

Lewis Solmon's paper reviews the relevant research on this question. His review of the literature reveals that school quality has substantially greater effects on changes in students' cognitive and behavioral outcomes in developing than in advanced countries. He also finds that school quality seems to affect the lifetime earnings of all students, regardless of the level of development of their countries. Solmon concludes that in the long run, the quality of schooling provided may be more important for the future economic prospects of developing nations than expanded access to poor quality education.

It is left to Bruce Fuller, however, to test the proposition. He chose Mexico as his example and has taken data from several periods ranging from 1880 to 1945. Using states with differing levels of investment in school quality and controlling for other intervening influences, Fuller demonstrates that states and communities that invested more heavily in the quality of education for their children tended to experience higher rates of growth or higher levels of economic development in most sectors a decade later.

Implementing Investments in Quality

Knowing that educational quality has an economic effect does not determine whether investments in educational quality will be successfully implemented. This is the subject of the rest of this volume. C. E. Beeby argues that educational systems proceed through a series of stages during which they are able to implement increasingly more complex educational investments. His conclusions and recommendations reflect almost sixty years of experience in advising educational systems in each stage of development.

The last chapter summarizes the experiences of World Bank staff who attended the conference. Sessions were dedicated to very specific issues, such as teacher training, examinations, prevocational subjects, and electronic media.

It is fair to say that some educational programs financed through World Bank loans and credits have been disappointing, that there have been errors in judgment, and that there have been instances of unrealistically high expectations. But it is also fair to say that there have been successes, with tangible and lasting improvements. This is true, for example, in the case of textbook production, teaching by radio, and teacher training. Moreover both Bank research and experience suggest that countries that have placed a higher level of emphasis on educational quality have experienced a higher level of economic growth and social prosperity.

Part I

Educational Quality and Economic Growth

2

The Quality of Education and Economic Growth: A Review of the Literature

Lewis C. Solmon

This chapter reviews evidence on ways to develop educational policies that would stimulate economic growth in developing countries. More specifically, the question is: to what extent can improved educational quality advance economic growth?

Educational quality has many dimensions. In the very poorest countries qualitative changes may simply mean more resources. A certain minimum is required to get any result at all. As more resources become available, the types of goods and services available in the school must be considered: the basic abilities, education, professional training, and in-service programs for teachers; availability of textbooks; availability of other support materials; ph ysica! plant, and so on. Quality is also a function of how students and others spend their time, both in and out of school. In addition, the importance of school quality depends on the availability of other learning modes at home, in the media, and in the community.

All of these factors will contribute to student learning, career development, and earnings. They affect human capital, which in turn contributes to national economic growth. The research to date tempers the standard policy of expanding primary schooling in developing countries without much regard for improving the quality of the education provided.

To assess the role of educational quality in national economic growth, one must ask whether schooling in general affects growth. Colclough (1980) has provided an excellent review of the evidence. "The case for investment in primary schooling is overwhelmingly that it makes people more productive at work and in the home . . ." (p. 19). For example provision of a primary school education to a substantial percentage of the citizens facilitates the attainment of social policy objectives, particularly in population control, health, nutrition, literacy, and communication. Colclough claims that these other goals also affect national development and growth: "The evidence suggests that the economic and social returns to investment in primary schooling in most developing countries are higher, at the present time, than other forms of educational investment" (p. 19).

In some of the poorest countries, where real rates of return on industrial and infrastructure projects are often small or even negative, the returns to investment in primary schooling appear to be very high indeed and more attractive than many alternatives. "In countries where a large proportion of the working population is dependent upon farming, and where rates of illiteracy are very high, primary schooling thus provides an investment opportunity which ought to have high priority on economic grounds" (p. 19).

The literature overwhelmingly concludes that more years of schooling provide a plethora of private and social or national benefits. It is also both logical and empirically established that there is a tradeoff between the quantity (years) and quality (expenditures per student) of schooling. Thus most benefits derived from low-quality schooling can be achieved faster if school quality is increased. To carry this argument further, if quality is as low as it is in some developing countries, improved quality could result in more benefits in fewer years. For example rather than needing six years to teach a labor force to read at what would be a fourth grade level in the United States, increased availability of school materials could result in the achievement of a fifth grade reading level in five years. In this case the nation would not have to give up the earnings of the students during

their sixth year of schooling and would have new workers entering the labor force a year earlier and with more skills. Where educated labor is scarce, the earlier entry of more accomplished workers into the labor force could contribute greatly to national income.

Moreover the dropout rate increases the longer a cohort of students remains in school. Thus if a certain educational goal can be achieved more quickly, a larger share of the participating students will complete it. In addition, a more amenable school atmosphere will encourage students to remain in school.

"The evidence shows that the benefits of primary schooling arise from the cognitive and non-cognitive behavioral changes which the schooling experience brings," Colclough says (p. 20). In fact it appears that attitudes and behavior are now changing even in school systems of very low quality.

"The implication is that even if resources are scarce, and if the affordable quality of schooling is low, a further extension of the coverage of primary education can still be expected to bring benefits. In this sense the evidence from fertility studies, and from studies of farmer productivity, suggest that the individual behavioral changes that result from schooling are stronger when literacy is widely spread than when it is more concentrated. There seems to be then an interactive effect between individual and community attitudes and values which significantly strengthens the economic and social case for universalizing access to primary schooling," Colclough says (p. 20).

At the present level of expenditure per pupil in developing countries, it is quite apparent that if more years of schooling have positive effects, higher-quality schooling for any level of attainment will make an even greater contribution. This can be deduced from the low absolute levels of material resources that exist in most developing countries, from the studies of the effects of school expenditures and school quality in such countries, and from the findings of studies in the United States that all imply that increased resources have the greatest effect in schools that have the fewest available resources.

Measuring Quality

It is clear that every year of attainment, even at the same nominal level of education, does not result in the same amount of learning. Consider the following:

- In 1980 in the United States current expenditures per pupil ranged from US$3,462 in New York State to US$1,574 in Arkansas (*World Almanac* 1983).
- In 1980 expenditures per student in four-year colleges in the United States ranged from less than US$2,000 to more than US$10,000.
- The recent value of classroom materials and other nonsalary recurrent investment per student enrolled in primary schools ranges from US$0.80 in Bolivia, to US$2.24 in Indonesia, to US$75 in Italy, to US$220 in the Netherlands and the United States, to more than US$300 in Sweden (Heyneman 1983).
- In the United States each elementary school pupil has access to an average of fourteen library books in addition to textbooks, reference books, and visual aids. In the Philippines ten pupils must share each primary school textbook. Thus typical pupils in the United States have more than 140 times the amount of reading material at their disposal than their Filipino counterparts (Heyneman 1983).

To equate a similar number of years attained by students in different regions and schools in the United States, to say nothing of comparing attainments of students in dissimilar nations, is ridiculous. According to unpublished estimates cited by Psacharopoulos (1983), in 1977 the average Western country invested fifty times more per pupil than did any of the thirty-six countries with per capita income below US$256.

Even if educational outcome or school effectiveness vary depending on resources available and on various school characteristics, there is a serious question about whether measures of expenditure per pupil adequately reflect such differences in schools. In general one would expect that where there was more money per student, each student would have access to "more" resources. It is more accurate to say, however, that more money spent per student would on average enable students to have more access to more expensive resources, not necessarily that all students are getting a better education.

High average expenditures per student in a nation or in a school district may mean that a few students are obtaining a large number of resources while many are getting very little. Thus the variance in the distribution of resources around a given mean must be considered. Even within a classroom, different students may have access to different amounts of resources, such as teacher time.

In addition, inputs to schooling that do not have market prices may vary greatly. Highly educated parents may contribute services in schools located in rich neighborhoods, whereas the parents in poor neighborhoods may be able to contribute only much less skilled labor or no labor at all if they must work at other jobs. Yet technically, expenditures per student may be equal for the two schools. In addition, certain families, particularly those with educated parents, can provide more complements to school training at home.

Hanushek's study of a few elementary school systems

concluded that "factors which are purchased by the school systems are not for the most part the characteristics of schools and teachers which are important in determining achievement levels. The bulk of instructional expenditures goes toward the purchase of three classes of inputs: class size, teacher experience, and teacher graduate education. . . . The characteristics of teachers which appear important in the estimated models include teacher verbal ability . . . , recentness of teacher educational experiences, and proportion of nonwhite teachers (which may be interpreted as a measure of the quality of educational experiences of nonwhite teachers)" (Hanushek 1972, pp. 108–10).

Consideration must be given to efficient combinations of resources. For example, if highly complex equipment that no one can operate is purchased or if highly skilled and highly paid teachers do not have access to textbooks, blackboards, or decent classrooms, both the effectivensss of the expenditures and the quality of the education will be low.

The evidence seems to show that there are substantial diminishing returns to per-pupil expenditures. At some point a certain percentage increase in expenditures will lead to a smaller percentage increase in quality (output). Thus where expenditures are five times higher, quality will not necessarily be five times as high.

It seems clear that in a world of less than perfectly competitive markets (that is, where dollars spent may not reflect productivity perfectly), differences in expenditures may not accurately reflect real differences in quality. When policy decisions are made, however, it seems that certain increases in spending per pupil could be directed so as to increase quality.

Quality Inputs

In developing countries a wide variety of quality components have been shown to affect student achievement. Quality matters more the poorer the setting. Class size does not seem to be an important factor within the relevant ranges in either developing or developed countries.

Teacher quality does seem to matter in developing countries, however. This is contrary to the apparent situation in the United States. When teacher salaries are set according to seniority or degree level, however, salaries are an inappropriate proxy for teacher quality; yet usually this is the only measure available.

Thus the available data suggest that the poorer the country, the greater the effect of school and teacher quality on achievement. This reflects the fact that, as a commodity, education is both scarce and in high demand.

A Review of the Literature

In low-income countries the power of educational attainment and of school achievement to determine occupational success may be substantially higher than the power of socioeconomic status or sex (Currie 1977; Fry 1980; Heyneman 1980; Schiefelbein and others 1983). Even when school and teacher quality are quantified and entered into regression models similar to the production-function paradigms of the 1960s, they appear to be the predominant influence on student learning around the world. The poorer the economic situation in a country, the more powerful this "school effect" appears to be.

Children who attend primary school in countries with low per capita incomes learn substantially less after similar amounts of time in school than do pupils in high-income countries. The lower the income of the country, however, the lower the correlation between pupils' social status and their achievement. Conversely in low-income countries the effect of school and teacher quality upon students' academic achievement in primary school is greater. From the data in numerous studies it is possible to conclude that the predominant influence on student learning is the quality of the schools and teachers to which they are exposed.

Schiefelbein and others (1983) studied the influence of school resources in Chile and concluded that investments in school quality are likely to have a substantial and positive effect upon students' success both in school and in the labor market. If they are to have significant effect on students from lower socioeconomic strata, improvements in school quality must start early in the educational process and be accompanied by attention to out-of-school problems, such as health and nutrition.

For both sexes educational variables are more powerful predictors of occupational attainment than is family social status. For females years of schooling is more important than educational achievement, and the latter has a negligible effect on occupational destination. Among males, however, the reverse is true; educational achievement suppresses the relatively small effect of years of schooling, but it operates negatively in relation to level of first job. For both sexes, educational quality variables are much more powerful predictors of occupational attainment than are either years of schooling or educational achievement. This relation is stronger among males than among females. Changes in levels of achievement are explained primarily by differences in the quality of the educational experience received rather than by differences in family background; this holds for students of both higher and lower socioeconomic status.

Loxley (1983) studied primary school quality in Egypt and found that school quality affects achievement more

than does the influence of the home. Apparently Egyptian primary schools do provide a learning environment that is independent of home resources and that affects pupil performance on tests of basic literacy skills. The incremental effects of school quality on the poor are greater than those found for children of advantaged backgrounds.

The net effect of the school is greater than the effect of the home: 14 percent of the variation in math achievement can be attributed to schooling and 6 percent can be accounted for by preschool influences entered into the regression equation first. For reading the percentages are 13 and 12, respectively. Clearly the school predicts the largest portion of variation in achievement in both math and reading performance in Egypt (Loxley 1983).

Although low-quality, poorly equipped schools may inhibit learning for any student, children of poor social background appear to perform appreciably better in high-quality schools than they do in the least productive schools. Students coming from illiterate households are more sensitive to school quality than students from advantaged households.

In an extensive review of teacher training on student achievement in developing countries, Husen and others (1978) conclude that teacher characteristics positively affect student achievement. Contrary to arguments presented in studies of schooling in the United States, the evidence in this study suggests that trained teachers do make a difference.

Numerous other studies of students in developing countries further confirm these general findings. Such studies include the work of Birdsall in Brazil (forthcoming) and that of Sabot (1983) on Tanzania and Kenya. The only negative findings regarding quality measures and educational effects pertain to class size. According to Haddad (1978, p. 12),

> It cannot be concluded than an increase in class size will necessarily lead to a decrease in the level of academic achievements of pupils. Likewise, a decrease in class size does not guarantee an improvement in the social environment of learning. What seems to be more important is what the teacher does with the opportunities provided by the size of the class. . . . It may be more cost-effective to increase class size moderately, and invest the annual savings in areas that prove to be effective, such as textbooks and qualified and motivated teachers. Farrell and Schiefelbein calculated that a 15-percent increase in the average class size in Chile would produce an annual saving equivalent to 5 percent of the 1970 annual budget, which together with savings from other measures can finance the components of a major educational reform.

Psacharopoulos (1983, p. 5) has summarized the findings on the effects of school quality in developing countries: "The dimension of educational quality is typically missing in quantitative measures of education." Yet the few existing studies of educational quality in this respect have shown quality to be economically and socially productive. Regardless of whether educational quality has been measured in terms of school buildings, laboratories, textbooks, teacher qualifications, nature of the curriculum, class size, composition of the student body, or expenditure per pupil, evidence more recent than the Coleman study of 1966 shows that such measures have an effect on enrollment (Birdsall 1982), on student achievement, and on adult earnings (Solmon 1975; Wachtel 1975; Rizzuto and Wachtel 1980). Also, the lower the per capita gross national product (GNP) of a country, the higher the effect that school quality appears to have on student learning and the lower the effect that factors of socioeconomic status appear to have on learning (Heyneman and Loxley 1983). The effect of enrollment within at least one country, Brazil, was greater among poor households (Birdsall 1982). Such different findings between rich and poor households or countries suggest decreasing returns to inputs designed to improve school quality; that is, such inputs are most effective when administered to a small existing base.

"Consideration of school quality might contribute to explaining the widening gap in economic performance between developing and advanced countries or the alleged failure of some economies to grow in spite of the rising educational attainment of their populations. Jamison and others (1981) report that whereas in 1960, the industrialized countries (members of the Organisation of Economic Co-operation and Development, OECD) on average invested sixteen times more per pupil than did any of the thirty-six countries with per capita incomes below US$265, by 1970 the difference had grown to 22:1 and by 1975 to 31:1. According to unpublished estimates this ratio stood at 50:1 in 1977" (Psacharopoulos 1983, p. 5).

School Learning and Job Performance

Since the amount students learn (achievement) is one (although not the only) factor in determining job performance and earnings, the fact that improvements in quality increase achievement in developing countries is very important. The links between quality and achievement are stronger in these countries than in the more developed world. Students in developing countries are more likely than, say, those in the United States, to improve their chances for success in careers (and so contribute to national economic development) when they do better on achievement tests.

In developing countries the amount learned at one level of education more directly relates, through entrance examinations, to one's probability of advancing to the next level. In the United States many factors besides test scores determine progression through the ranks of education. At the early stages, merely completing one grade gets a child into the next. At higher levels, grades and personal attributes are considered along with test scores. In some developing countries, however, student progress is based exclusively on test scores.

In many developing countries the civil service is a much larger segment of the formal labor force than is the case in more advanced countries. Since exams frequently are required to obtain civil service jobs, again ability to perform on such examinations is important for a high probability of career progress.

Finally, in many developing countries there are no avenues to learning other than schools. Whereas youngsters in advanced countries can avail themselves of television, libraries, newspapers, neighbors, and educated family members, those in developing countries must learn in school or not acquire any human capital at all.

For all these reasons one would expect school quality to more strongly affect learning and, through attainment, career success in the developing world. The studies to date confirm this expectation. Unfortunately, the bulk of the evidence deals with learning. Information on the links between school quality and earnings is available primarily in studies on the more advanced nations.

Decisions about Methodology

The evidence on the relation between the quality of education and economic growth is quite varied. Some is clearly more convincing than others. It usually is obtained from studies of the most advanced nations.

To assist policymaking for developing countries, an important methodological decision must be made at the outset. "Comparative" educators must deal constantly with the question of what evidence is relevant or helpful for developing nations. For the problem at hand much of the research focuses on the most developed countries and particularly on the United States. A small literature is now emerging, primarily from World Bank researchers, on the effects of educational quality in the developing world.

The advantages of the work on the United States are the greater completeness (types of variables), comprehensiveness (nationally representative), and accuracy of the data used. Thus, fuller models can be tested, and studies using alternative data bases can replicate and confirm the findings. In some cases data have been collected over a number of years, so longitudinal research can be conducted. In addition, measures of both inputs and outputs have been somewhat standardized from survey to survey.

The most obvious problem of applying findings from the United States to the developing countries is one of relevance. Can policies inferred from observing different effects of expenditures of US$1,000 and US$3,000 per student be recommended to nations that spend US$2 per student? In a simplistic sense the answer is clearly no. But that choice is too trivial. The real question is what can we learn about principles, relations, and trends by looking at particular aspects of the U.S. studies? And of course the transference from developed to developing countries must utilize the comparative educators' knowledge of differences in institutions, customs, and wealth, among other things, across nations. If the choice is to base policy for developing nations upon scanty data from those countries or upon much better research from nations less like them, it seems clear that the latter source of evidence must at least be considered.

A second argument for the usefulness of U.S. research lies in the great diversity of the United States both over time and across regions. This has enabled groups of people to be compared according to how they resemble the people in developing countries. In particular, blacks in southern U.S. states have typically had fewer educational resources than have whites in northern and western states. Therefore a comparison of the effects of different quantities and qualities of education for blacks and whites or northerners and southerners will produce insights into the effects in other nations that have relatively few educational resources. The experience of U.S. blacks is quite useful in predicting how increased educational resources may affect students in developing countries.

Microstudies in the United States

In the early 1970s various economists began to analyze several data bases of individuals to determine the effects of quality education on earnings. In general, the proxy for school quality was expenditure per student, usually in the state where the student was educated, but at times data were available for individual school districts. A significant problem in most of the studies was that resource data for the specific schools that students attended were unavailable. Nevertheless the results from the different studies were consistent and strong.

Johnson and Stafford (1973) looked at people in the 1965 University of Michigan Survey Research Center Panel who had attended school in the 1930s, 1940s, and 1950s. The sample was restricted to white males who had earnings in 1964; the dependent variable was average hourly earnings. The study found that there were

positive but diminishing returns to per-pupil expenditures on schooling; the estimated coefficient on the log of expenditure per pupil variables was 0.198, significant at the 0.1 percent level. When students in the North were considered separately, the coefficient fell to 0.159. This implies that returns to quality in the South, in which expenditures were lower, were higher than returns in the North.

An extra US$100 of expenditure per pupil reduced the amount of schooling necessary to reach a certain stock of human capital by about nine-tenths of a year. There are, in general, much higher returns to quality of schooling than to years of schooling. This indicates that too few educational resources have been invested in school quality. The rate of return to quality, however, appears to diminish rather sharply as expenditures are increased. At the highest levels of expenditure, returns to quantity and quality are about equal.

Johnson and Stafford also conclude that the quality of the public school attended should have a positive effect on the decision to stay in school longer. That is, quality lowers the psychic costs of remaining in school longer, which results in greater attainment and therefore higher income.

The findings of this paper and others are not necessarily inconsistent with those of Jencks (1972) and Coleman and others (1966), who argue that the quality of schooling has little effect on measures of output, such as tests of cognitive skills. Their findings are based on three arguments: there are no precise links between test scores and earnings; even if there was a strong link, most tests of relations between input and output rely on measures of statistical association, not causation; and Jencks relies upon goodness of fit (R-squared), whereas Johnson and Stafford's interpretations are based on point estimates from the regressions.

Johnson and Stafford were not able to include measures of individual ability or of parental background. Nevertheless subsequent studies, which did include such factors, appear to confirm their findings. In 1975 Link and Rutledge used the 1968 National Longitudinal Sample ("Parnes") data to corroborate the Johnson and Stafford study. Their dependent variable was the log of annual, rather than hourly, earnings; they had district-by-district, rather than state data on expenditure per student; they included measures of ability and experience in the labor market; and they included blacks in the analysis. Of course, differences in expenditures within districts were still unknown.

Link and Rutledge concluded that the return to quality (expenditures) for whites was 0.176 and that returns to quality in general were high but diminishing. The IQ measure reduces the coefficient for years by 15 percent and for quality by 10 percent, but Johnson and Stafford's conclusions do not change. In fact they further confirm Johnson and Stafford's findings of a tradeoff between quantity and quality of education. That is, a student might benefit as much from fewer years of better schooling as from more years of worse schooling.

For blacks they found that years of schooling had a negligible direct effect on earnings. In contrast increased expenditure per student had a larger and statistically significant direct effect on earnings; the estimated elasticity of earnings with respect to expenditure was about 0.57, or more than three times the estimate for whites. Since blacks start with much lower expenditures per student than do whites, their circumstances are closer to students in developing countries than to whites in the United States. That is, these findings imply that increased expenditures per student in developing countries would have huge payoffs in increased earnings and productivity, as seems to be the case for blacks in the United States.

Link and Rutledge also confirmed Welch's (1975) finding that improvements in the quality of education have played a significant role in narrowing the differences in earnings between blacks and whites. The calculated negligible returns to quantity of education indicate that public programs that increase years of schooling for blacks without simultaneously increasing the quality of schooling will most likely fail.

Also in 1975 Ribich and Murphy used National Longitudinal data on workers five years after high school graduation to determine how educational quality, ability, and socioeconomic status affect educational attainment, ability, and subsequently income. They concluded that just because expenditures do not affect test scores does not mean they do not affect income. Better quality education develops personal attributes that are useful in the job market or conducive to greater interest in continuing schooling. Despite small direct effects between expenditures and income in the North, the indirect effects through increased years of schooling are important. Moreover in the South expenditures positively affect both test scores and educational attainment. Finally high socioeconomic status has a role in directing children toward schools with a high level of expenditure per student.

Akin and Garfinkel (1977) used a later version (1968–72) of the Michigan "SRC Panel" of the longitudinal data to look at black and white males between the ages of 30 and 55 in 1972. They concluded that high-quality schools provide socialization, increasing self-confidence, and academic and vocational skills, which are unlikely to be taught in schools with low levels of expenditure per student. Expenditures had a small effect on ability scores, and such scores had a similarly small effect on earnings. But expenditures have a greater effect on years completed and, directly, on income. Overall, rates of return on expenditures per student for whites

range from 9 to 15 percent and for blacks from 13 to 20 percent. They also stress nonfinancial returns. Like other researchers Akin and Garfinkel found the rate of return to be uniformly higher for blacks than for whites, despite the fact that many of the school expenditure coefficients for blacks are smaller than those for whites. Two reasons for this are suggested. First blacks attend school for fewer years and so begin to accrue benefits earlier. Second the mean expenditure per black student is lower than for each white one, so any increment will have a greater effect.

Finally Rizzuto and Wachtel (1980) used data from the 1960 and 1970 censuses of population and concluded that rates of return to quality are higher for blacks (0.33 to 0.35) than for whites (0.13 to 0.17) and are higher than returns to quantity (0.07 to 0.08 for whites and slightly less for blacks). They argued that there has been underinvestment in quality of schooling in the 1970s, particularly for blacks. There may be benefits in allocating a greater proportion of educational budgets to programs that improve the quality of elementary and secondary schooling and a smaller proportion for programs that require or encourage higher attainment.

Rizzuto and Wachtel also tested other possible measures of school quality. They found that the ratio of pupils to teachers and measures of teacher salaries were less important than were expenditures per student or longer school years.

Some might argue that these strong and consistent findings for the United States are not directly relevant to developing countries. Evidence on diminishing returns to expenditures per student, however, along with the greater observed returns to blacks than to whites (blacks have traditionally been in lower quality schools) suggest that in developing countries with very low expenditures per student and commensurately few available real resources, the payoff to quality (increased expenditures) would be immense. If the experience in the United States can serve as a guide, this would be the case particularly if additional resources were used to achieve things other than increase teacher salaries or decrease class sizes.

A review of the research has shown that:

- School quality has a much greater effect on student test scores in developing countries than in the United States.
- School quality appears to have a substantial effect on subsequent earnings of students in the United States; however there is little evidence either for or against this relation in developing countries.

These two results can be reconciled in several ways. First, U.S. evidence on diminishing returns to school quality would imply that where the level of quality is very low, as in developing countries, the effect on either achievement or earnings will be greater than it would be where resources (quality) are more abundant. Second, increased school quality affects earnings in more ways than by merely increasing achievement. Finally, the translation of human capital into earnings depends on institutional arrangements, the relative scarcity of productive workers, and complementary factors in the production process.

The Conflict between Quality and Equity

Since the "Great Society" days of the mid-1960s there have been serious efforts in the United States and other countries to expand educational opportunities at all levels for the poor and for minorities. "Equal educational opportunity" has been viewed by many to mean "equal access," however, and equal access was thought to have been achieved if everyone who so desired could get into some educational institution. Thus, access to education of high quality was of less concern.

If indeed it matters not only how long one is in school but also what quality of education one gets, then to ignore quality is a serious problem. At the elementary and secondary level the problem is compounded if policymakers are unable to define what quality is. Since universal access has generally been achieved at the precollege level in the United States, an equal distribution of quality was, at least implicitly, sought. But since no one knew how to identify quality, it was assumed that if resources were equally distributed—perhaps by prohibiting wealthy districts from spending more than others for education or by distributing the students according to various busing plans—at least everyone would get the same quality education, even if not a high quality education. The resources used to achieve equal opportunity—programs like compensatory education, busing, and greater administrative overhead—have alternative uses.

If these incremental costs could be paid for by additional funds, then there would be no reason to sacrifice existing programs. But if resources are diverted from traditional uses, the move toward equity may lower the quality of education, particularly in the public schools. Resources for public schools have diminished under the double burden of tax limitation initiatives and inflation. And in many areas "white flight" has lowered the effect of peer groups on children with low socioeconomic status. Loss of resources, changes in student composition, and crime, among other factors, have led many good teachers to leave the public schools as well.

On balance the situation for students who formerly were receiving the lowest quality elementary and secondary education may have improved. It remains to be shown how the quality of education has changed for others, however. If the gains in productive capacity by

those whose quality of education has improved are greater (or worth more) than the losses in productivity of those whose educational quality has declined, then society has become better off. But we will not know the net effects of the tradeoff between quality and equity until such determinations are made.

At the postsecondary level in the United States the problems are similar, but there are also additional ones. The first stage in seeking equal access was to assure that everyone desiring to enter a postsecondary school could do so. Beginning in 1972 the federal government established massive student aid programs to help the disadvantaged. Even though most very poor students can receive sufficient financial aid to cover the direct costs of expensive colleges, the costs covered exclude forgone earnings. And many poor students still do not attend the most expensive private colleges and universities, some of which are generally viewed as providing the highest quality education. In the past several decades two-year colleges have proliferated and expanded, and these are the schools to which most minority and poor students have had access.

Moreover some formerly high-quality colleges, such as those in the system of the City University of New York, experimented with open admissions programs, which were costly and disruptive and which diverted some of the financial and human resources from their former purpose of educating the better prepared students. Even universities that stopped short of open admissions but that tried to increase the diversity of their student bodies became involved in remedial programs; special courses, such as women's and minority studies; and new counseling activities. Even though many of these activities were funded from new money rather than from ordinary funds, certainly some funds were reallocated, and so fewer resources could be devoted to traditional efforts of educating only the best prepared students.

Thus at the college level many new students have been educated. But the real question is whether, as some people have argued, the average quality of education being received by all students has declined. Certainly some students are receiving the high-quality education that had previously been available. But it is unclear whether the increase in number of college students has compensated for the decline in the quality of education received in terms of the productive capacity of the college-educated labor force. On the one hand there may be a higher economic return, both to the individuals educated and to society, to providing high-quality education to the most able than to providing lower-quality education to more students. On the other hand some have argued that the overall social benefits would be greater if even more resources were diverted from the more-or-less able (Astin 1973). This is an empirical question that must await further analysis rather than more rhetoric.

During the past decade the relative economic advantage in the labor force of college-educated compared with noncollege-educated persons has declined (Freeman 1976). It has not yet been determined how much of this is the result of an increase in supply of, relative to demand for, college graduates and how much is a result of the reduced productivity of graduates from poorer-quality colleges. But it has been widely stated that quality will once again become the primary goal of educators in the United States in the 1980s. Such a refocusing may result in part from the realization that tradeoffs between quality and equity may have to be made.

In the developing world the problem of the tradeoff between equity and quality may be even more severe. In many instances attendance at even the lowest levels of schooling has been reserved for those with high socioeconomic status. Thus any attempt to slow expanded access to improve quality of the education may be viewed as an attempt to divert even more resources to the rich.

Politically it will be difficult for many governments to achieve higher-quality education at the expense of expanded access. This might be an important reason for an outside agency such as the World Bank to promote quality. This would enable the domestic government to continue to use internal resources to widen access. But if the quality of education is very low, merely expanding access will serve the national interest poorly.

Improvements in the quality of schooling provided in developing countries may be more important for the future economic prospects of these nations in the long run than will expanded access to poor quality education. Thus the quandary of equity versus efficiency will have to be addressed in these countries as it has been in the United States and other developed nations.

Ultimately, additional questions not related to education will also have to be addressed to facilitate development. These may range from issues of debt service and trade balances to agricultural policy and procedures for utilizing natural resources.

All of these problems will require money to solve. But unless sufficient resources are committed to improving each nation's stock of human capital, and until these resources are effectively allocated within the educational systems, the developing countries will be at a serious disadvantage in the continuing quest for greater wealth and prosperity.

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3

School Quality and Economic Growth in Mexico

Bruce Fuller, Kathleen Gorman, and John Edwards

Faith in the belief that education helps drive economic growth has dwindled considerably during the past decade. Research has seriously challenged the assumption that higher levels of school investment and quality will boost the individual's academic achievement or eventual economic success in the labor market (Coleman and others 1966; Jencks and others 1979). Prior estimates of the contribution of educational attainment to national economic growth (Denison 1967; Schultz 1971) now also appear to have been overly optimistic (Barnhouse-Walters and Rubinson 1983).

Yet findings from research on achievement and economic effects of school investments within industrial nations should not be generalized to developing countries, nor even applied to all historical periods within any country. Recent work, for instance, reveals that incremental improvements in school quality have yielded sizable gains in student achievement in several developing nations (for review, see Psacharopoulos 1983). The relative influence of school attainment and quality in relation to family background appears to be much stronger in developing countries than within industrial nations (Heyneman and Loxley 1983). Investments in schools may also be more potent in boosting the individual's success in the labor market within the developing world compared with more industrialized nations. In Chile, for example, school quality—including textbook availability and class size—were strong determinants of occupational success (Schiefelbein and Farrell 1984).

This chapter asks whether investment in schools contributes to economic output at the national level. The economic effects of schooling quantity and quality are usually examined by following individuals from school into the labor market. But the structure of the economy—that through which the individual moves—is assumed to be constant (Bowman 1976). Work has just begun to measure directly the influence of investment in schools on the productivity and growth of a *nation* and to move beyond growth-accounting methods or inferring social returns of education from aggregated individual-level experience (for review, Rubinson and Ralph 1984). This chapter directly assesses the effect of school investment and quality on the national output of a developing country.

The specific topic of this chapter is the contribution of education to early agricultural and industrial growth in Mexico between 1880 and 1945. Mexico offers an intriguing case. Before the revolution of 1910–17 Mexico strongly encouraged urban-centered industrial development spurred by infusions of foreign capital. After the revolution, however, Mexico shifted toward a rural-focused strategy of agricultural development and discouraged investment in mining and manufacturing (Reynolds 1970a). Patterns of investment in schools also changed dramatically between these two periods as a result of the sharp switch in social priorities. Schooling moved from locally controlled, largely urban institu-

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tions to a federally dominated movement, which was designed to help organize rural communities around shared economic and social goals. Mexican history thus provides an opportunity to examine the effect of school investments on growth under two distinct economic structures and contrasting education policies.

Investment in Schools and National Growth

This chapter builds on, yet departs somewhat from, the way economic effects of school investment have been studied within the framework of human capital. Current debate over school investments and whether they boost academic achievement or economic benefits is exposing limitations both in how the issue has been conceptualized and in the research methods that are often used. This look at the contribution of school investment and quality to economic growth in Mexico responds to several points of criticism directed at past literature.

Much of the research on economic returns to educational investment has utilized data on individuals and typically examined how youth with variable levels (and quality) of schooling achieve in the labor market (for example, Hansen 1970; Psacharopoulos 1973; Sewell and Hauser 1975; Bowman and others 1981). The assumption about human capital in this work is that schooling imparts skills and attitudes that lead to greater productivity, which is measured in wage gains and aggregated social returns. However, the theory of class conflict suggests that schooling may affect wages because some youths hold higher credentials, not necessarily because they gain higher technical proficiencies from their education. Level of schooling could consistently covary with the relative positions of individuals in the labor and wage structure; yet aggregate productivity and national growth are not necessarily affected (Berg 1970; Thurow 1974; Collins 1979). The traditional framework for human capital also assumes constant patterns of labor demand: the economic structure presumably discriminates between individuals (holding variable skills and educational attainment constant) in similar ways over time (Bowman 1976). At times, however, the labor market favors subgroups with low or high status. One example of this is the higher rates of return from education for blacks in the United States during the 1970s (Hanushek 1979; Rizzuto and Wachtel 1980).

The process of school investment is viewed as largely occurring at an institutional, as well as at an individual or family, level. Particularly in early stages of national economic development investment in school quantity and quality is part of institution-building processes designed to boost educational levels, technological innovation, regional trade, and a national consciousness (Meyer 1977). Government investment in schools at local, state, and national levels expresses a desire to integrate individuals and communities into a more tightly organized economy and social structure. Schooling establishes universal knowledge (reading and writing ability), a common language, and a more widely based political order (Bendix 1964; Althusser 1971). Research on individuals may actually underestimate the economic effects of school investment by missing the institutional and regional events, such as the accumulation of knowledge. In addition regional or national decisions about educational investment may shape growth differently in various economic sectors. One question in this chapter is whether post-revolutionary Mexico was able to boost agricultural production through investments in schooling. This is one example of how school investments may be an exogenous force, which complements capital investment strategies that focus on growth in a particular economic sector (at the community level, see Jamison and Lau 1982). The central point is that school investments at national or regional levels may better demonstrate the economic benefits and costs than the level of the individual.

The growth accounting method of estimating the contribution of education has also been used to examine the economic effects of education at the national level (Denison 1967, 1974). Simply assuming that the economic growth not explained by capital, land, and labor inputs was shaped by education and technological innovation, however, may have overestimated the effect of investments in schooling at the national level. Barnhouse-Walters and Rubinson (1983) directly measured and modeled the effect of educational attainment and found that primary schooling significantly affected national output. The influence was considerably less than the growth accounting methods had estimated, and the effect appeared only for the early industrial period in the United States.[1] The production-function method was used to model longitudinal effects of school investment by assessing the economic effect of alternative measures of investment in school quantity and quality after controlling the effects of capital, labor, and cultivated land (Hanushek 1979).

Dimensions of Quantity and Quality in School Investment

Early research defined school investment, for both individuals and nations, as the quantity of schooling attained for an individual or a nation's labor force. But school investments can have several qualitative components as well. School quality has been measured in terms of expenditure per student, character of school facilities, strength of academic programs, class size, social composition of students enrolled, and teachers' salary levels or qualifications (for review, see Solmon, chapter 2; Welch 1976). These quality ingredients of schooling have been found to influence both individual

academic achievement and success in the labor market. Expenditure per pupil, the ratio of students to teachers within the school, and teacher salaries appear to influence school and economic experience significantly, when family background within the United States is controlled for (Wachtel 1975; Akin and Garfinkel 1977; Rizzuto and Wachtel 1980). Initial evidence suggests that school quality (in terms of expenditure per pupil) also shapes rates of growth in pupil persistence through school and state-level income, when earlier efforts at school expansion are controlled for (Solmon 1975; Fuller 1983). Although a tradeoff appears to exist between the quantity of investment and school quality, little is known about which qualitative factors and what mix yield the greatest academic achievement and economic effects.

The distinction between school expansion and school quality is particularly important in assessing the effects of educational investment in the developing world. For instance in the thirty-six poorest nations, with per capita GNP of US$265 or less, average enrollment rose from 48 to 70 percent of school-age children between 1960 and 1977 (Heyneman and others 1984). Yet within this remarkable spurt of institutional growth and access to education lie vast variations in school quality. For teacher salaries, for example, Malawi spends only one-sixth of the resources allocated by Bolivia (Heyneman 1982). Contrasts are even sharper between industrial and developing nations. In 1975 members of the OECD spent thirty-five times more resources per student than the world's poorest countries (World Bank 1980). In 1977 ten students are enrolled for every one textbook in the Philippines (Heyneman and others 1980).

Variation in school quality also touches levels of academic achievement. In twenty-nine low-income nations Heyneman and Loxley (1983) found that school quality shapes sizable portions of variance in students' achievement. In the poorest nations, such as India and Colombia, school quality played a stronger role than family background. Incremental improvement in the availability of textbooks, instructional materials, and even radio instruction have revealed similar gains in achievement among students in Nicaragua (Jamison and others 1981), Malawi (Heyneman 1980), and Malaysia (Haron 1978). Effects are at times quite significant. A control-group evaluation of increasing textbook availability in the Philippines, for instance, found an increase in one-third of a standard deviation in first and second grade math achievement across 8 million students. This means that the level achieved by 50 percent of all students in the first year was attained by 63 percent of all pupils the next year after additional textbooks were introduced (Heyneman and others 1984).

However little evidence exists that links school quality to economic gains within the developing world. The previously cited study in Chile is an important exception in which textbook availability, teaching quality, and class size contributed to labor market success more efficaciously than length of schooling (quantity) or family background (Schiefelbein and Farrell 1984). Jamison and Lau (1982) also found that persistence through four years of elementary schooling raised the farm productivity of individuals by 9 percent. In that study the dependent economic effect was measured in concrete output (rather than by using wage rates as a proxy for presumed productivity gains), and the effects on growth pertain to one particular economic sector. This study on Mexico extends this line of work and relates levels of school investment and qualitative aspects of public investments to economic output over time.

Historical Specificity of the Effects of School Investment

School investments may produce particular effects only within certain stages of development or particular economic structures. Research on human capital at the individual level has not examined the variation in the structure of occupations or the dynamics of labor demand patterns as change occurs during historical periods. Analyzing worldwide data on educational attainment across nations, Benavot (1982) found that during 1950–70 investment in primary schooling boosted economic development for poorer countries but not for more industrialized nations. Similarly Barnhouse-Walters and Rubinson (1983) found that primary schooling significantly helped predict early industrial growth in the United States (1890–1929), although secondary schooling nudged development after 1933. Technological innovation and assumed shifts in job skills may also have boosted the growth of primary schools in the former period, then reinforced secondary school expansion in the late industrial period (Rubinson and Ralph 1984). This work does not emphasize how differing dimensions of the quantity and quality of investment may variably influence economic growth under specific historical conditions; yet a focus on the efficacy of different levels of instruction and types of curricula (for example, primary versus secondary or academic versus vocational) offers a strong beginning point for future research.

Determining the Direction of Causality

Past approaches to the study of the effects of investment in human capital have been criticized for modeling the process in the wrong direction. Rather than arguing that school investments boost economic growth, the class-conflict perspective proposes that the structures of the economy and of the state determine the growth and character of school institutions (Bowles and Gintis 1976;

Collins 1979; Hogan 1982). Little doubt exists that labor market demand in part shapes school enrollment rates and school investments by governments. Supportive empirical evidence exists both for industrializing settings (Katz and others 1982; Fuller 1983) and within developing countries, such as Mexico (Goldblatt 1972).

This chapter, however, focuses on a model that views school investments and quality as antecedents to economic growth. The rise of school institutions preceded commercial expansion and industrialization in many settings, including nineteenth century France (Baker and Harrigan 1980), the United States (Fishlow 1966; Meyer and others 1979), and Mexico (Díaz Covarrubias 1875; Wilson 1941). To some extent social values and commitment to school institution building, which are often rooted in religious convictions and faith in literacy training, operate somewhat independently of economic factors (Lipset 1972; Tyack and Hansot 1982). In addition schooling investments in time 1 historically precede growth in certain emergent industrial or commercial sectors in time 2. This reality requires that economic structure be considered a dependent variable. This chapter does not assume that school investment patterns are not affected by previous social class structures, even those operating within early agrarian and local commercial elements of the economy (Soltow and Stevens 1981). School investments may also allocate economic gains within unequal patterns (Carnoy 1972; Levin 1984), as happened in prerevolutionary Mexico. Yet the focus here is on the extent to which school investments and quality may spur growth in new or young economic sectors of a developing nation.

In summary this chapter looks at how measures of school quality among Mexico's thirty-two states have affected economic output from 1880 to 1945. This approach allows an assessment of the role of educational investment and quality on direct measures of economic output. Before the methodology and findings are discussed, however, the policies on school investment and patterns of economic growth in Mexico are outlined. This sets the theoretical issues within Mexico's own historical context.

Historical Background

The theoretical issue of how school expansion and school quality influence economic growth must be situated within Mexico's own historical experience and cultural goals.

The Aims and Quality of Mexico's Schools

Two elements of Mexico's educational history are especially pertinent to the discussion of school quality. First is the issue of who controlled the financing and administration of the schools. Second is the question of how the content of schooling matched the economic and social priorities of the government.

Education in colonial Mexico was largely controlled by the church. Secular elements of the government successfully advocated public support of schools only after Mexico achieved independence from Spain in 1821. Liberal reforms of the independence era and during *La Reforma* in the 1850s would eventually constrain the church's ability even to operate primary schools. Yet an increasingly secular federal government would not replicate the church's level of centralized administration until after the revolution of 1910–17. Throughout the latter half of the nineteenth century primary education occurred within private schools or small institutions supported by municipal governments (Larroyo 1948; Wilson 1941). In 1875, 87 percent of Mexico's 8,103 primary schools were operated by municipal authorities, 603 were supported by state governments, and the remainder by churches or private associations (Hamilton 1884; Díaz Covarrubias 1875).

The federal government did urge that public free schools be established, both during the reformist administration of Benito Juarez and in the early years of the Porfirio Díaz regime. The organic laws of public instruction (1867) required municipalities to establish a primary school for every 500 inhabitants and urged *hacienda* (estate) owners to create schools for the children of farmworkers and miners (Universidad Nacional Autonoma 1967; Vaughan 1982). In 1875 the Díaz administration mandated school attendance for all school-age children. Ironically this mandate was exercised when not more than one-fifth of all children entered primary school and only 15 percent of all Mexicans were literate. The federal government did not begin to subsidize schools run by the states and municipalities until 1888.

Local control of education greatly influenced the investment in, and quality of, the schools. In the 1870s annual expenditure per student enrolled in public schools equaled only 5.4 pesos, equivalent to two weeks' wages of a farm laborer. But in private schools 24 pesos were expended per child (Díaz Covarrubias 1875). Urban families and children benefited most from private schools. Within Mexico City 40 percent of all primary schools were private. Municipalities that prospered from coastal trade or mining were better able to raise public revenues for schools. Urban philanthropists and private societies also helped to support schools (Banda 1873).[2] In addition economic firms, particularly in mining, created their own schools to ease labor shortages (Maillefert 1865; Wilson 1941).

Initially municipal and private primary schools simply borrowed curricula and materials from the Catholic institutions, which emphasized classical training in morality, religious doctrine, and the humanities. After

the mid-1800s, however, the secular state would recurrently encourage more Western educational philosophy. Reformers argued that schooling should not teach just conformity through strict instruction and recitation. Instead education should nurture the individual development necessary for political independence and economic success within a postcolonial, free market economic structure (Sierra 1969; Knowlton 1976). Curricula and policy emanating from the federal government—along with financial subsidies—increasingly argued that schools should impart job skills and social norms that were closely linked to modern sector jobs and urban lives. Instruction in urban life, the French language, and moral behavior were integrated with older curricula in mathematics, science, and history (Sierra 1910; Benjamin and Ocasio-Meléndez 1984).[3] This coupling of public primary schools and the modern urban economy occurred even though two-thirds of all workers in the formal labor market in 1900 were engaged in agriculture, not urban commerce or manufacturing.

The growth in school investments before the revolution was remarkable. The number of primary schools in Mexico rose from 5,240 in 1843 to 10,592 in 1902 (Ortíz 1930) (Table 3-1). Yet by 1907 less than one-third of all children were enrolled in primary school, and a third of those enrolled attended school infrequently. In poor states such as Chiapas and Oaxaca less than 20 percent of all children ever enrolled in a primary school (Vaughan 1982). Twenty-five years after compulsory attendance laws were passed, states and municipalities were still inducing higher attendance by giving students free clothes and meals and by threatening parents with fines or even jail for failing to send their children to school (Callcott 1965).

Beyond low levels of educational investment per capita and low enrollment rates, concrete signs of variable school quality were apparent. Teachers supported by municipal governments earned about 25 pesos a month in the 1870s, roughly the same wage of a carpenter and less than that of many mine workers (Wells 1887; Vaughan 1982). Rural school teachers earned as little as one-fourth the wages paid in commercial centers. During this period only five teacher training schools provided formal teacher training. Quality standards set by state or local governments were symbolic at best. In Chihuahua in 1909 all schools were to have labs, a sink, a bathroom, and a playground; only two schools met these standards (Sierra 1910). Teachers were at times evaluated on the basis of their students' performance on exams, with an 80 percent passage rate deemed satisfactory by school inspectors. Yet as late as 1927 more than 40 percent of all first grade students did not pass the national exam.[4]

The quality of rural schools—where they managed to operate—was very low. In 1910 the state of Zacatecas closed many of its 251 rural schools because of inadequate buildings and an inability to find teachers (Vaughan 1982). Double standards of quality were also applied to rural schools. In the early 1900s the federal government approved a national school calendar but allowed rural areas to ignore it during planting and harvest seasons. Although urban schools were inspected

Table 3-1. *Growth of Schools in Mexico, 1843–1940*

Item	*1843*[a]	*1875*	*1888–93*[b]	*1925–28*[c]	*1936–40*[d]
Number of primary schools	5,240	8,103	9,039	16,692	22,205
Municipal		9,751	4,755		8,831 (state)
State or federal			4,284	3,943	13,374 (federal)
Private or church		2,017		2,998	
School expenditures (millions of pesos)		2.8	3.3 (1907 = 11.3)	45.0	106.3
Municipal		1.0		3.6	2.7
State or federal		0.4		41.4	103.6
Private		1.2			
Annual school expenditures per student (pesos)					
Public		5.4	9.6	32.1	53.0
Private		24.0			
Literacy rate (percent)			14–18	33	42

Note: All expenditure data are in current dollars. Between 1877 and 1900 the peso's value declined by 86 percent against the U.S. dollar (Sollano Ramos 1961). From 1900 to 1920 absolute inflation in Mexico (not pegged to the U.S. dollar) rose by 21.6 percent. Between 1920 and 1940 the peso's value actually gained 2.5 percent (Wilkie 1970). Blanks indicate unavailable data.

Sources: a. Data for 1843 and 1875 are from Días Covarrubias (1875) and Ortiz (1939). b. Callcott (1931). c. Vaughan (1982) and Stanley (1948). d. Stanley (1948).

for the quality of instruction in math, science, and modern languages, rural schools were expected to focus on manual skills, "intuitive knowledge," and the Spanish language (Sierra 1910).

Investment in Schools after 1917

Successive federal administrations redirected school investments substantially following the revolution of 1910–17. Implications for school quality can be examined through the same two elements summarized for the eras before 1917: who controlled school investment policy, and how were the quality and character of schools shaped to help push economic development?

The federal government assumed strong central direction of school investments. Between 1910 and 1923 annual federal support of schools grew from 9 million to 29 million (constant 1923) pesos. The number of federally built primary schools increased fivefold during this time. By 1925 the federal government provided just over one-half of all public funding for schools. The once dominant share of municipal government support had fallen to less than 10 percent of all apportionments (Stanley 1948).[5] Spurred by the rising federal investment, 46 percent of all school-age children were at least registered in school by 1927.

This burgeoning level of federal investment in schools was focused on rural development—both to boost agricultural productivity and to improve the quality of life in the countryside. Revolutionary ideals of this era were embodied by the vision of increasing literacy, integrating Indians into the modern state, and equitably redistributing land and wealth to rural peasants (Sanchez 1936; Ruíz 1963). More than 80 percent of primary schools built by the federal government between 1907 and 1928 were located in rural areas. Between direct federal support and strengthened mandates on ranchers and factory owners to open classrooms for their workers, the number of rural schools rose from just over 1,000 in 1921 to 13,700 in 1947 (Secretaría de Educación Publica 1926; Wilkie 1970).

The content of primary schooling also shifted to emphasize rural development. The revolution had to some extent repudiated free market, individualistic economic values and instead urged cooperative agrarian and industrial action to boost domestic productivity (Tannenbaum 1933). Rural school "missions" became the tool for organizing villages in the countryside to address problems of illiteracy, primitive farming techniques, and poor health care in a comprehensive fashion. The rural teacher was part instructor, part community leader (Sanchez 1936). Many rural schools operated collective farms, ran small industries such as furniture-making, raised chickens, and operated cooperative banks for their village (Callcott 1931). The rural school movement was in part a manifestation of the government's desire to encourage a national consciousness to emphasize a Mexican identity, was independent of foreign business, and assimilated various regions and Indian groups into a cohesive social framework (Vasconcelos 1923; Ramos 1941). The secular state communicated themes of cooperation, solidarity, and national self-reliance through the rural schools (Ebaugh, 1931).[6]

Despite these gains in building school institutions quality was mixed. In 1927, for instance, forty-three students were enrolled for every teacher. Ninety percent of all rural schools consisted of one large room with only tables and chairs and very few instructional materials. In this same year enrollment in the third grade was just 10 percent the level of first grade enrollment (Stanley 1948). As late as 1950, 60 percent of all children enrolled attended the first grade (Myers 1965). In 1920 the state of Sonora was spending only 6 pesos per capita on public education (about two days' wages of a railroad worker; Bell 1922), even though the appropriation for education was fifteen times higher than before the revolution. Trained teachers were in very short supply, particularly given the rapid rate of school expansion. Wage rates did not indicate, however, a shortage of people willing to join the movement. Rural teachers entering the federal school system earned 2 pesos a day, which was comparable with workers in manufacturing (Wasserman 1984).

The federal government addressed issues of quality by centralizing standards and encouraging local commitment. Villages were asked to donate land and labor to build and support the rural schools. The national administration standardized curricula, enforced national examinations, and expanded (both pre- and in-service) teacher training (Sanchez 1936). Although improvements in quality took a long time to implement, Mexico's expansion of school investment had tangible effects. For example the nation's literacy rate increased from 23 percent in 1910 to 42 percent in 1940 (Wilkie 1970).

This brief historical outline of Mexico's investments in education and the resulting variable quality of schools (the antecedent factors of interest) should be matched against a brief sketch of economic development patterns (the dependent variables) from 1880 to 1945. The historical background in these two areas will help to illuminate the empirical models and to interpret the findings.

Patterns of Economic Development

Into the early 1900s Mexico maintained a colonial economic structure based on the export of minerals, tobacco, tropical fruits, and livestock. As early as 1810 rising domestic demand had also spurred modest pro-

duction in manufacturing, particularly within a modest textile industry. In that year New Spain's output comprised mining (15 percent of total value), manufacturing (29 percent), and agriculture (56 percent); (Meyer and Sherman 1979). In 1884, US$37 million in gold and silver were exported, which constituted 75 percent of all exports (Hamilton 1884).

This economic structure was reinforced between 1877 and 1910 under the administration of Porfirio Díaz. Díaz encouraged foreign investment and growth in domestic manufacturing. During this period foreign trade increased fourfold. By 1916, US$647 million in capital was invested in the mining industry, 95 percent of it from the United States, Britain, and France. By 1899, 118 cotton factories were operating and were centered primarily in the Federal District, Puebla, and Jalisco. Mexico's GNP increased 3.7 percent a year from 1876 to 1910, compared with a 1.6 percent a year after the revolution from 1920 to 1940 (Derossi 1971).

Agricultural exports grew by 47 percent in the last decade of the nineteenth century.[7] Yet the aggregate value of Mexico's agricultural production in 1882 was low relative to international standards and equaled only the value of oat production in the United States. Díaz did little to urge greater rural productivity, which was already constrained by a feudal agrarian order dominated by *haciendas* and *ranchos*. In 1910, 97 percent of rural family heads owned no land at all. Mexico's 840 *hacendados* controlled most cultivated land and relied on inexpensive farm workers rather than investing in more productive technology (Hager 1916; Callcott 1931; Glade and Anderson 1963; Cockcroft 1968).

Mexico's shift toward rural development and nationalization of heavy industry was clearly felt following 1917. Tables 3-2 and 3-3 show the structure of Mexico's gross domestic product (GDP) and economic growth rates before and after the period of reform from 1910 to 1917. Discouragement of foreign investment and eventual state control of rail and petroleum companies greatly reduced available capital (Mosk 1950; Reynolds 1970a). Federal policy was, however, efficacious in boosting agricultural productivity. The annual growth rate moved from 1.0 percent between 1900 and 1910 to 2.7 percent between 1925 and 1940 (Table 3-3).

Table 3-3. *Annual Growth Rates of the Economic Sectors, 1900–40*
(percent)

	1900–10	*1910–25*	*1925–40*
Gross domestic product (GDP)	3.3	2.5	1.6
Population	1.1	0.1	1.6
Real per capita GDP	2.2	2.4	0.0
Agricultural production	1.0	0.1	2.7
Manufacturing	3.6	1.7	4.3
Mining and petroleum	7.2	5.6	−1.9
Total exports	4.5	3.9	−1.4
Total imports	1.3	3.1	−3.5

Sources: Reynolds (1970a, 1970b).

The regional geography of Mexico is also an important factor in economic development. Historically centers of production were located in rural areas around mines and haciendas, while the nation's more than fifty coastal ports grew because of trade, commerce, and government activity. At times, both hacienda owners and mine operators were faced with wage competition from the modernizing sectors of more urban economies. Similarly the textile industry moved from hiring mostly men to employing more women in the latter third of the nineteenth century (Wells 1887; Chavez Orozco 1937). In addition migration from the city back to the hinterlands increased recurrently because factories were becoming increasingly mechanized, price competition was working against small-scale household industries, and land reform was expected (Reynolds 1970a). This issue of

Table 3-2. *Size of Gross Domestic Product (GDP) Components and Labor Market Sectors, 1900–40*
(percent)

	1900		*1930*		*1940*	
	GDP	*Employment*	*GDP*	*Employment*	*GDP*	*Employment*
Agriculture	29.9	65.9	23.7	70.2	23.0	65.4
Crop production	14.3	n.a.	13.1	n.a.	12.6	n.a.
Livestock	15.6	n.a.	10.6	n.a.	10.4	n.a.
Manufacturing	13.2	14.4	16.7	13.4	18.0	10.9
Mining	6.4	2.2	9.8	1.0	5.6	1.8
Transport	3.1	n.a.	2.8	n.a.	5.3	n.a.
Other	47.4	17.4	47.0	15.4	48.1	21.9

n.a. Not available.

a. Wilkie (1970) reports that agricultural employment declined from 68.3 to 63.4 percent between 1910 and 1940. Yet the size of rural labor force participation as a proportion of all active workers grew from 61.9 to 71.4 percent between 1900 and 1930, but then dropped closer to Wilkie's reported level by 1940 (Reynolds 1970a).

migration between sectors is important in conceptualizing how investments in schools might differentially influence growth or decline within different economic spheres. Textile factories in rural areas paid higher wages than working farms (Nash 1958). In turn urban manufacturers and commercial firms paid more when they had to compete for labor with government and trade enterprises. Since education presumably increased job alternatives, wage competition and costs increased within certain sectors. In sum the effects of school investment on economic growth may vary depending on the economic sector (Hage 1980).

Linking School Investment and Quality to Economic Growth

For this study several variables representing school quality and economic development were included for Mexico's thirty-one states (or territories) and the Federal District (thirty jurisdictions before 1910). The study examines how variation in school investment patterns among these units helps to explain growth or decline within economic sectors between 1880 and 1945. To illustrate covariation between school quality and economic development, Table 3-4 compares states with the highest levels of school investment with states that were the least committed to educational institutions.

Several indicators of investment and quality varied between the two groups of states. For instance the states with the highest levels of investment spent 51 centavos per capita on schools in 1888; the states with lowest levels of investment expended only 16 centavos annually. High investment states had a literacy rate of 29 percent versus only 6 percent in low investment jurisdictions. The data illustrate the complexity of the measures of school quality. The number of students enrolled per teacher was considerably higher in states with the highest investment, counter to expectations. Higher enrollment rates per capita did not necessarily mean that institutional resources could keep pace with demand.

Table 3-4 also shows how the economies of the two groups of states differed twelve years later in 1900. Although causality cannot be inferred based on these simple tabulations, the differences between the groups are interesting. States with the lowest levels of investment were more rural and had lower mine and cigarette production. But these states displayed comparable agricultural and textile output relative to states with the highest levels of investment. Manufacturing related to tobacco was based in cities, while textile factories were distributed throughout both urban and rural areas. Thus the link between the wealth of a state and its level of investment in schools also appears to be related to both rural agricultural production and urban-centered industry.

Table 3-4. *Comparison of Mexican States with High and Low Levels of School Investment*

	States with highest levels of school investment (means)	*States with lowest levels of school investment (means)*
Education features, 1880–88		
School expenditures for instruction per capita (peso)	0.51	0.16
Literacy rate (percent)	29	6
Percent of all residents enrolled in school	5.6	3.3
Percent of students who presented year-end exams	44	66
Number of residents per municipally supported school	1,420	1,969
Number of residents per state or federally supported school	24,482	18,204
Number of students enrolled per teacher	113	47
Number of residents per published newspaper	29,906	96,441
Economic features, 1900–10		
Percent population living in towns with at least 2,500 residents	57	79
Value of agricultural output per capita (pesos)	10.3	9.8
Value of mining output per capita (pesos)	9.3	4.0
Value of textile production per capita (pesos)	3.0	4.3
State government revenues per capita (pesos)	1.7	1.2
Volume of cigarette production per capita (cigarettes)	51	12

Note: States with high levels of investment in schools include Chihuahua, the Federal District, Jalisco, Morelos, Nuevo Leon, Sonora, and Veracruz. States with low levels of investment include Chiapas, Durango, Guerrero, Michoacan, Oaxaca, Queretero, and Tlaxcala.
Sources: Wilkie (1970), Wilson (1941), Vaughan (1982), and the authors' data analysis.

Methodology and Procedures of the Study

We turn next to an empirical test of the basic question: did school expansion and school quality help spark early growth in Mexico?

Data Collection

Several federal agencies published statistics on schools and economic activity in each of the two periods studied: 1880–1910 and 1920–45. The data come from federal surveys and budget documents related to school support, tax reports on agricultural activity and various industries, and commerce reports. In addition the decennial census, begun in the 1890s, provides figures on occupations, school attainment, and literacy. (See Note 4 for a complete list of the data sources.) Very few of the indicators necessary for conventional time-series analyses were published annually. Instead both modified production-function and panel-analysis models have been used. These models use data falling into four panels: the 1880s (time 1), 1900–10 (time 2), 1923–28 (time 3), and 1940–45 (time 4). The models examine the influence of school investment and quality in times 1 and 3 on measures of economic output in times 2 and 4, respectively.

The Models Used

Two types of models were constructed to predict levels of economic output. They differ on when education effects are expected to occur: either in the same year or lagged twenty years. The two models also disaggregate economic inputs, such as capital and land under cultivation, differently. The production-function model, which is constructed for the periods before 1910 and after 1920, adapts the Cobb-Douglas approach. The influence of school investment and quality indicators on economic output (Q) are examined after controlling for production inputs: capital investment (K), the labor participation rate (L), and amount of land under cultivation (N). For example

$$Q_t = aK_t^b L_t^c N_t^d T_t^e E_{t-1}^f.$$

Production inputs are assumed to influence output simultaneously. Literacy (T) is a candidate variable for entry, and school investment and school quality measures (E), lagged from time 1, are allowed to enter the equation (using a $p = 0.10$ level of statistical significance). Given the limited number of cases (thirty over times 1 and 2 and thirty-two cases over times 3 and 4), no more than three school quality measures were allowed to enter any regression equation. The Cobb-Douglas model assumes interaction between all independent variables. Logged values for variables on both sides of each equation are reported, which allows use of least-squares regression while retaining the model's multiplicative character (Walters 1970; Barnhouse-Walters and Rubinson 1983).

The level of variables are observed at two times (for both the 1880–1900 and the 1925–45 eras), and the variation among Mexico's states are studied. Capital investment, land, labor, and literacy are assumed to affect output in the same year; school investment and quality measures are lagged by twelve to twenty years, depending on data availability. This builds from the traditional production-function approach. Yet rather than using annual time-series data, observations across the Mexican states are used for each panel of data.

The second approach uses a conventional panel-analysis model, in which the influence of school quality in times 1 and 3 on economic output in times 2 and 4 is examined, holding economic activity in times 1 and 3 constant. This approach assumes that prior levels of economic output will largely determine output ten or twenty years later, but a portion of the unexplained variance may be shaped by patterns of school investment. Rather than controlling for capital, land, and labor in time 2, the level of economic activity in time 1 (for each economic sector) is controlled. School investments are then entered to examine the influence on output in time 2. For instance

$$\ln(EA_t) = a + b^* \ln(EA_{t-1}) + c^* \ln(T_{t-1}) + d^* \ln(E_{t-1})$$

where EA stands for economic activity, T for literacy, and E for measures of school investment. Again, literacy and school investment measures are candidates for entry based on the criterion of minimum significance. This panel-analysis approach allows economic indicators to be combined within sectors in which reliable composite measures can be constructed, rather than differentiating between capital, land, and labor inputs. This may help to stabilize models, particularly when a moderate number of states or cases is used. The natural log of output, economic activity, and school investment measures are used to ensure comparability with the production-function model.

Exact measures of some economic variables did not always exist for the two time periods; yet in most cases composites could be constructed that showed strong correlation across the two periods, which provided efficacious control measures. This is an important point related to the validity of inferring causality from these longitudinal analyses for both production-function and panel analyses. For example where production inputs and controls do not show expected association with the output measures, any relation between levels of school investment and output may be simply related to variation in state wealth. But when the controls and inputs

are highly related to output, the effects of overall wealth will be largely partialed out, which strengthens the likelihood that school investment was indeed affecting the growth or decline in economic output. The panel-analysis approach has been used to examine longitudinal effects of school growth on economic development and the reciprocal relation (Meyer and Hannan 1979; Benavot 1982; Fuller 1983).

Reduction of the Data

Production-function models assume that the different elements of economic activity (capital, labor, and output) are collected in a reliable fashion. Panel-analyses also benefit from the use of identical measures at two points when controlling for the prior level of economic activity. But such pure data are not always available for developing nations, especially detailed reports on early periods of growth. Composite measures were at times used as proxies for certain constructs. For example the value of mining and textile manufacturing was reported for Mexican states in 1900; yet output for other industrial sectors, especially firms located in urban areas, was not reported. The volume of cigarette manufacturing and federal tax on this industrial sector were highly associated measures, however (Cronbach's alpha = 0.70). This composite was used as a proxy for output in tobacco manufacturing. In addition various measures of school investment and quality were reported. Factor analyses for principal components were performed to determine patterns of clustering among various indicators and thus to provide reliable composites. All indicators were adjusted to represent per capital levels of activity, except for ratios such as the rate of labor force participation or ratio of students per teacher.

Measures for Time 1 (1880) and Time 2 (1900)

Economic variables for time 2 first consisted of the overall rate of participation in the formal labor market, given that precise workloads were not available by economic sector. A rate measure was used to match the per capita level of activity used for the other variables. The amount of land under cultivation was estimated for each state based on figures for agricultural volume reported by crop, from 1900 and contemporary crop yield data (Secretaría de Programación y Presupuesto 1981).

Various indicators of capital investment were available; three composites were constructed based on reliability levels and the expected relation of the measures to related output variables. Production-functions were not built when an output measure could not be matched with a significantly associated measure of capital, given that the examination of the effects of school quality is useful only to the extent that other inputs can be adequately controlled. Capital investment in mining was measured by combining figures on the number, horsepower, and value of mining machines operating within each state (alpha = 0.91). The best measure of capital investment in textile manufacturing was the number of factories operating per capita. A measure of urban-based capital accumulation was used to examine the contribution of capital to the output of tobacco manufacturing. This includes the level of capital investment in tobacco factories and the concentration of landlords (alpha = 0.92). The composite was used as a measure of urban capital, which justified the mix of capital from two sectors.[8] No measure of capital investment was available for agricultural production. By most accounts farm work was highly labor intensive from 1880 to 1900. Even large haciendas reportedly used very little machinery (Wells 1887; Redfield 1930).

A direct measure of the value of textile output was available for time 2 (1900). Two measures of mining output—one for haciendas and one for all other mines—were combined into a composite (alpha = 0.84). A direct measure of the value of agricultural output was also reported. Finally the measure of urban capital was matched with the indicator of tobacco manufacturing output described above.

For the panel analyses two control variables for economic activity were available in time 1 (1880) for each of three sectors. In agriculture the value of land converted to cooperative farms was highly related to agricultural output in time 2 (1900). Agricultural output in 1878 was also used as a control variable. Measures of the value of mineral exports and trade in nonmetal goods (two indicators, alpha = 0.86) were highly related to both textile production and tobacco-related manufacturing and offered valid control variables.

Several measures of school investment and quality were narrowed down to two composites. A composite of local educational resources was built from six indicators that measured school expenditures, the ratio of student attendance to enrollment, and the availability of newspapers and libraries (alpha = 0.79). This composite basically tapped the level of municipal commitment to schools and institutions linked to literacy. A second composite was related to the availability of state and federal support of schools and was independent of the first measure (alpha = 0.96). A direct measure of the expenditures allocated per pupil in 1874 was also used. In addition state literacy rates were used as candidate variables, subject to the minimum standard for entering the regressions ($p = 0.10$). The literacy figure for 1900 was used in production-function models and the 1880 estimated rate for the panel analyses.

Measures for Time 3 (1925) and Time 4 (1945)

More complete figures on economic activity and school investments were published after 1917. For the

production-function equations the overall rate of formal labor force participation was also used in time 4 (1940). Direct measures of land cultivated with maiz and frijol were summed and used as an estimate of land. Investment in irrigation was used to indicate capital in the agricultural sector. In manufacturing separate measures of total capital investment and the value of factory machinery per capita were combined into a composite (alpha = 0.88). A direct measure of total capital invested in mines was available for time 4.

Agricultural output was measured from the value of regionally exported maiz and frijol (alpha = 0.99). Then, since the value of livestock produced and agricultural and commercial tax revenues shared considerable communality, they were combined into a composite measure of agricultural output (alpha = 0.86). A direct measure of the value of mining was used. Manufacturing output was measured from the value of output, the aggregate of industrial wages earned, and the levels of state tax revenue (alpha = 0.92).

For the panel analyses a composite economic control for time 3 (1925) for agriculture consisted of the reported value of rural and all farms (alpha = 0.88). In manufacturing the composite included value-added to all manufacturing and capital investment in tobacco factories (alpha = 0.97). Finally the value of exports, level of municipal taxes, and business tax revenues were combined into a composite measure of urban-based economic activity (alpha = 0.86). This control variable for time 3 was matched with a direct measure of value of export activity for time 4.

Measures of school investment and quality were abundant for time 3 (1925). Principal-components factor analysis indicated some degree of independence among the various measures. Measures of school investment analyzed here fall into three categories:

- Institution building—relating to overall expenditures, numbers of schools constructed, and enrollment rates per capita
- Quality within the school—including measures of the student-teacher ratio, pupils' passage rate on annual exams, and teacher salary levels
- Sector-specific investment—using separate measures of private, technical or vocational, and rural school investment.

Findings of the Study

Results for the production-function models for 1880–1900 are reported in Table 3-5. For the agricultural sector the land variable is strongly significant in predicting output. Literacy (1900) enters significantly and holds a positive effect on output. Higher levels of state and federal support of schools is associated with lower agricultural output during this period. Capital investment strongly determined value of output in mining. School investment had no effect. Within the manufacturing sector levels of capital investment contributed substantially to output. Literacy shows a negative effect for textile manufacturing. In the more urban-centered tobacco industry, expenditures per student increased output.

Table 3-6 reports findings for the panel models during this same period. In each sector the controls for time 1 entered significantly, especially within the textile and tobacco elements of manufacturing. In agriculture expenditures per pupil boosted output from 1880 to 1900. The literacy rate in 1880 appears to have had a positive influence on textile output, yet a negative effect on tobacco manufacturing. The negative influence of liter-

Table 3-5. ***Influence of School Investments on Economic Output, 1880–1900: Production Function Model***

				School investments, 1880				
Economic output, 1900	*Capital*	*Labor participation*	*Estimate of cultivated land*	*Local commitment*	*State or federal resources*	*Expenditures per student*	*Literacy, 1900*	*R-square (percent)*
Agriculture	n.a.	1.10	0.95[a]		−0.51[c]		0.85[b]	98
		(1.93)	(0.03)		(0.27)		(0.33)	
Mining	0.22[a]	0.92	0.01					40
	(0.06)	(0.83)	(0.01)					
Manufacturing								
Textiles	1.89[a]	−0.78	0.02				−0.83[c]	96
	(0.08)	(2.72)	(0.04)				(0.44)	
Tobacco manufacturing	0.42[a]	0.15	0.02			1.18[b]		55
	(0.09)	(0.88)	(0.01)			(0.56)		

Note: Unstandardized betas and standard errors (in parentheses) are reported. Each model used logged values. Blanks indicate no significant effects.

n.a. Not available.

a. $p = 0.01$; b. $p = 0.05$; c. $p = 0.10$.

Table 3-6. ***Influence of Investment in Schools on Economic Growth, 1880–1900: Panel Analysis Model***

Economic output, 1900	*Time 1 (1880) Economic control(s)*	*School investments, 1880*				
		Local commitment	*State or federal resources*	*Expenditures per student*	*Literacy, 1880*	*R-square (percent)*
	Ejidos					
	Agricultural output (1878)					
Agriculture	−5.06[c]			4.11[a]		38
	(2.99)			(1.26)		
	0.54					
	(2.12)					
Manufacturing	Nonmetal trade					
	Metal exports					
Textiles	−19.82[a]				36.02[c]	54
	(3.98)				(18.38)	
	1.10[c]					
	(0.64)					
Tobacco manufacturing	−1.04[a]	1.12[a]			−5.32[b]	56
	(0.38)	(0.22)			(2.21)	
	0.13[b]					
	(0.06)					

Note: Unstandardized betas and standard errors (in parentheses) are reported. Each model used logged values.
a. $p = 0.01$; b. $p = 0.05$; c. $p = 0.10$.

Table 3-7. ***Influence of Investment in Schools on Economic Output, 1925–45: Production Function Model***

	Agriculture			
	Crop production	*Agricultural commerce*	*Mining*	*Manufacturing*
Economic factors, 1940–45				
Capital	−0.07[b]	−0.01	0.011[a]	0.87[a]
	(0.03)	(0.03)	(0.002)	(0.08)
Land cultivated	0.14[a]	−0.02	0.000	−0.09[a]
	(0.04)	(0.04)	(0.001)	(0.02)
Labor participation	−0.87	9.32[b]	−0.03	8.14[a]
	(3.61)	(4.59)	(0.15)	(2.13)
School Investment measures, 1925–28				
Ratio of school inspectors to primary schools	−17.50[a]			
	(5.33)			
Salary expenditures per federal school teacher	0.49[a]			
	(0.12)			
Federal expenditures per student and per capita		0.47[b]		
		(0.20)		
Proportion of school-age children enrolled in private primaries			−2.31[b]	
			(1.10)	
Ratio of rural schools to rural school-age children			(−0.12)[c]	
			(0.06)	
Proportion of school-age children enrolled in federal primaries				31.62[a]
				(5.63)
Small class size/student pass rate (composite)				1.72[a]
				(0.49)
Literacy rate, 1940		7.67[a]		
		(2.41)		
R-square (percent)	59	67	52	92

Note: Unstandardized betas and standard errors (in parentheses) are reported. All variables reported are for logged values.
a. $p = 0.01$; b. $p = 0.05$; c. $p = 0.10$.

acy, however, occurs in the equation after the positive effect of local educational resources has been partialed out.

Findings for 1925–40 are reported in Tables 3-7 and 3-8. The production-function models show that capital investment significantly affects output in each regression, except for the measure of output of agrarian commerce, in which labor participation significantly enters. Higher levels of school investment and quality appear to boost output except for the mining sector, in which commitments for private and rural schools lowered mining output. Heavier investment in school inspectors also seems to have depressed agricultural growth after the revolution.

Table 3-8 illustrates findings for the corresponding panel analyses. At least one of the economic controls for time 3 (1925) enters strongly for each economic sector. Federal school expenditures boosted output in agriculture. Sector-specific investments in both private and technical schools were negatively related to rural production (the private school variable is the ratio of residents to private primary schools). The composite measure of school quality—lower student-teacher ratios and higher attendance rates—increased export and trade activity. Here too enrollment in technical schools diminished trade activity during this period.

Discussion and Future Work

These findings suggest that the level and character of investment in schools historically influenced Mexico's economic output, at least within the agricultural and manufacturing sectors. These patterns of influence differ somewhat between the two eras, and the effects may not always be positive. For example the level of school investment from central state and federal governments before the revolution appears to have been negatively associated with agricultural growth. This may have resulted from the urban focus of schools during this time. State and federal funding may simply have reinforced the emphasis of municipal government on improving schools in trading centers. And the local authorities were, after all, the greatest backers of schools at this point. After 1917 school investment—now focused on rural development—positively influenced agricultural output. There are two exceptions, however. Investment in technical schools and government inspection appear

Table 3-8. ***Influence of Investment in Schools on Economic Growth, 1925–45: Panel Analysis Model***

	Agricultural or crop production	*Mining*	*Manufacturing*	*Export activity*
	Farm value	Exports or municipal tax	Value of textile output	Exports or municipal tax
Time 1 (1925)	0.41[a]	0.01[b]	−0.3	0.08[a]
Economic control(s)	(0.14)	(0.005)	(43.6)	(0.01)
			Value-added in manufacturing	Value-added in manufacturing
			0.69[b]	0.04[b]
			(0.32)	(0.02)
School investment measures, 1925–28				
Federal expenditures	0.36[a]			
	(0.12)			
Residents per private primary school	0.0001[a]			
	(0.00004)			
Enrollment rate in federal technical school	−6.69[c]			−0.60[a]
	(3.40)			(0.19)
Students enrolled per federal primary school				2.86[b]
				(0.62)
Ratio of students to teachers in all primary schools				−0.06[a]
				(0.02)
R-square (percent)	53	14	16	85

Note: Unstandardized betas and standard errors (in parentheses) are reported. All variables reported are for logged values with one exception. The regression run for agricultural crop output is for raw per capita values, given the weakness of the time 1 economic control variable when all values were logged.

a. $p = 0.01$; b. $p = 0.05$; c. $p = 0.10$.

to be negatively related to output. Yet the number of primary schools per capita, teacher salary levels, and total federal expenditures for education all appear to exert a positive influence on agrarian output after controlling for states' wealth, capital investment, and land under cultivation. These findings appear for both the production-function and the panel-analysis models.

The contribution of school investment and quality to manufacturing output is less clear. First conflicting positive and negative effects of literacy were observed before 1917 on textile output between the production-function model (which used a control for direct capital investment and the literacy rate for 1900) and the panel-analysis model (in which economic activity controls for time 1 and the literacy rate for 1880 were entered). These contrasting effects may result from the different control measures or from a change in literacy patterns between 1880 and 1900. Further work is needed to sort this out. One possibility, however, is that increased literacy drove up wages in textiles as modern sector jobs rapidly expanded for a fledgling middle-class during the late nineteenth century. Evidence does indicate that during this period the proportion of women textile workers rose from about 30 to 50 percent, which indicates changing patterns of labor demand and perhaps a shift toward higher paying occupations for men (Chavez Orozco 1937; Gonzalez Navarro 1970). After 1917 school investment and quality (especially low class size and high student performance, Table 3-7) appear to have raised aggregate manufacturing output. The strength of this production-function equation is evidenced by the fact that all three production inputs affected output when entered as controls before school investment measures. This more consistent effect may result from a higher rate of return on education when Mexico's industrial sector boomed before and during World War II (Reynolds 1970a). This positive effect may have been an unintended consequence of investment in rural schools interacting with urban migration during this period of economic growth.

More thought should be given to the structure of school quality, particularly after 1917 when diverse measures become available. The approach here has been to move beyond global measures of school attainment or expenditures per pupil, which have been used in past research on economic growth and school quality. This initial investigation of the factor structure of school investment and quality yielded a variety of somewhat independent dimensions. Future work should reduce available measures to clearer indicators of the quantity of investment in schools and the quality of schools.

In addition the patterns discovered here should be examined for the period after 1945. Rapid growth in Mexico continued into the 1950s. Some observers feel that investments in education after the revolution came to fruition even more clearly during this time. This analysis also should be moved toward an investigation of school investment and economic growth within local economies. School attainment and economic data exist for Mexican *municipios* after 1900. Analysis of these data may yield a more fine-grained picture of whether, and the extent to which, school investments have helped shape Mexico's economic growth.

Notes

1. Barnhouse-Walters and Rubinson's findings (1983) are not conclusive, as they point out. Their regression models for the early U.S. industrial period were at times not stable where the measure of capital took on a negative coefficient. Unstable or weak effects for some indicators of capital investment were apparent for a small subset of models pertaining to Mexico that were tested. These equations were subsequently dropped.

2. A private association, La Compania Lancasterana, operated schools according to Lancasterian ideals advocated in Europe. The emphasis on strict order and rote instruction blended well with teaching of the church catechism. These schools were later absorbed by municipal school authorities and provided a transition between religious and secular institutions in both content and method. At the end of the nineteenth century Lancasterian schools were outlawed as remnants of a nonmodern, constraining social order of the past (Barranco 1915).

3. The struggle within schools to appear modern at times took rather awkward turns. One school textbook, urged on municipal schools by the federal government, included instruction in how to celebrate the U.S. holiday of Thanksgiving (Secretaria de Instrucción Publica 1905).

4. Primary sources of data.

a. Population, occupational, social, and literacy data from decennial census documents.

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Secretaria de Programación y Presupuesto. 1982. *Décimo Censo General de Población y Vivienda, 1980: Resolutados Preliminares Nivel y por Entidad Federativa.* Mexico City.

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5. Rising school appropriations reflected a substantial shift in federal social policies. Between 1920 and 1927 the annual budget for national defense declined by 40 percent, from 124 million to 76 million pesos (Callcott 1931). Between 1920 and 1945 federal budget appropriations increased from 25.7 to 105.6 (1950 constant) pesos per capita (Wilkie 1970).

Federal support of Mexican schools has continued to increase. The federal share currently is 70 percent of all funding. State governments provide 22 percent of all funding, and private sources, such as industrial and agricultural company schools, cover the remaining 8 percent (Neumann and Cunningham 1982).

6. Recurrent efforts by both state and federal Latin American governments to encourage cooperative action and attitudes are explored by Van Young (1984) for the Guadalajara region and Bak (1983) for Brazil.

7. In the early 1880s Mexico's annual agricultural production comprised the following major crops: *maiz* (US$112 million), wheat (US$17 million), sugar (US$9 million), *frijol* or beans (US$8 million), cotton (US$7 million), coffee (US$2.6 million), and tobacco (US$2.0 million).

8. This composite measure of tobacco manufacturing and concentration of landlords is a valid indicator of capital accumulation in urban centers in 1900. The correlation between this composite and the proportion of residents living in towns of 2,500 or less equals -0.67 ($p = 0.001$). By 1940, however, the correlation between manufacturing output and this rural measure equaled -0.33 ($p = 0.06$).

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Part II

Implementing Investments in Quality

4

The Stages of Growth in Educational Systems

C. E. Beeby

This chapter is about the nature of change in educational systems, and the conditions that are necessary to bring it about. My theories about school change and quality improvements are based on almost forty years of experience and observations in both industrial and developing countries.

Basically I have learned that change is a slow and ragged process that does not proceed uniformly on all fronts. Teachers are the frontline troops of change, and progress depends on their own education, motivation, and freedom to innovate. As a result massive reforms that are mandated from a national department of education cannot be expected to occur overnight.

There is no such thing as a general definition of educational quality, since the concept of quality depends on one's concept of the ultimate purpose and objectives of education. This varies from country to country, from group to group, and even among individuals. Nevertheless in all developing countries there are obvious educational changes to be made that everybody would accept as improvements, whatever their views on the ultimate ideal school.

For several decades now the World Bank and other agencies have been involved in efforts to help improve both the access to, and the quality of, schools in developing countries. Although questions of access predominated in the 1960s, the emphasis shifted to quality issues in the 1970s.

Success Is Illusive

Looking back, it is clear that many attempts to improve the quality of schooling have failed. There are many reasons for those failures. Although there are certain political and material reasons that prevent particular projects from succeeding, only the structural problems intrinsic to most of the failures are considered here.

Behind every failure of this kind there lies, in my experience, an inability to realize that change in the quality of classroom practice is a matter of growth—a living, inward change in the minds of individuals, which is not brought about solely by manipulating external influences such as laws, official syllabuses, instructions, sanctions . . . or even money. There seem to be certain laws of growth: certain factors stimulate it, others inhibit it. When educational planners fail to recognize these laws, two kinds of miscalculations result:

- Planners who have not had extensive experience in educational administration rarely understand how difficult it is for teachers to change their classroom practice. They seldom know the type of in-service training that is necessary to help average and below-average teachers make even limited changes. This frequently means that the gap between an old syllabus and a new one is too wide for many teachers to bridge.
- Partly as a consequence of this and partly as a result of failing to understand the history of educational change in older countries, planners often grossly underestimate the time it will take to bring about real change in classroom practice.

The standards found in the best schools of the richer countries took a century to develop. Trial-and-error, pilot projects, the contribution of individual pioneers, and the slow absorption of new ideas and attitudes played a far bigger part than did overall planning.

Developing countries trying to follow the same track

face a completely new problem. They want to compress generations of change into a decade. This is commonplace in the literature. What is not so commonly realized, either in theory or in practice, is that this compression forces processes that are by their very nature successive to occur simultaneously or nearly simultaneously.

If compression occurs in the operative phase of a program as well as in the planning phase, it can lead to confusion, frustration, and grievous loss of money, effort, and good will. In the planning phase the techniques of systems analysis can help prevent some of this, but such techniques can be misleading at the operational phase, where changes in the classroom depend on the slow and sometimes unpredictable changes in the attitudes and skills of teachers and, to a lesser degree, of students. The attitude of the Bank regarding timing is crucial in any project concerned with improving quality in the classroom. Some phases of an operation may need to be speeded up, while others may need to be slowed down and extended.

Stages of Growth

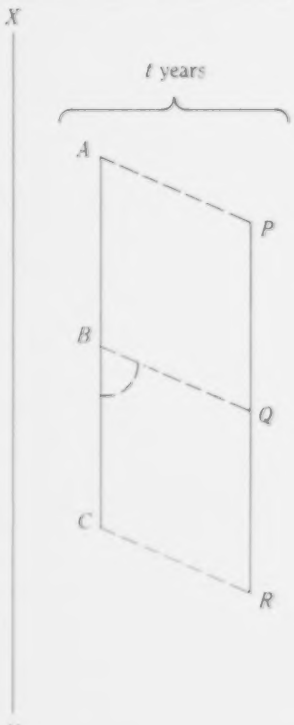
My thesis is that there are four stages in the growth of a primary school system in countries of all types (Beeby 1966); they are set out in the model below and in Table 4-1. Stage I (the dame school stage) can, for present purposes, be ignored. The progression from the beginning of stage II (formalism) to the end of stage IV (meaning) occurs in three ways:

- The teachers become better educated and more fully trained
- Teaching becomes less rigid, narrow, and stereotyped and less dependent on mass methods of instruction and rote memorization
- The links between symbols and their meaning become stronger and wider, more attention is given to the abilities and needs of individuals, and students are encouraged to solve problems and think for themselves (Beeby 1980).

Change in this direction represents improvement in

Table 4-1. *Stages in the Growth of a Primary School System*

Stage	*Teachers*	*Characteristics*	*Distribution of teachers*
I. Dame school	Ill-educated, untrained	Unorganized, relatively meaningless symbols; very narrow subject content—three R's; very low standards; memorization all-important.	
II. Formalism	Ill-educated, trained	Highly organized; symbols with limited meaning; rigid syllabus; emphasis on three R's; rigid methods—"one best way"; one textbook; external examinations; inspection stressed; discipline tight and external; memorization heavily stressed; emotional life largely ignored.	
III. Transition	Better-educated, trained	Roughly same goals as stage II, but more efficiently achieved; more emphasis on meaning, but still rather "thin" and formal; syllabus and textbooks less restrictive, but teachers hesitate to use greater freedom; final leaving examination often restricts experimentation; little in classroom to cater for emotional and creative life of child.	
IV. Meaning	Well-educated, well-trained	Meaning and understanding stressed; somewhat wider curricula, variety of content and methods; individual differences catered for; activity methods, problem solving, and creativity; internal tests; relaxed and positive discipline; emotional and aesthetic life, as well as intellectual; closer relations with community; better buildings and equipment essential.	



the quality of classroom work; movement in the opposite direction is regression. To speak of a school system as if all parts of it were ever at exactly the same stage would be an oversimplification. The last column of the table shows the probable distribution of the teachers on the quality scale. The vertical line *XY* represents the continuous scale of growth from the beginning of stage I to the end of stage IV. The average teacher is at *B* on the quality scale just before the reforms are instituted, and the spread *AC* indicates that the best teachers are a full stage ahead of the least able. After *t* years of the programs of reform the general standard of the teaching has improved, but there is still a wide spread of teachers on the quality scale *PR*, with the average teacher at *Q*. Except under the experimental conditions established by Bloom (1976) in his research on the effects of mastery learning, there will always be a spread in the quality of teaching in any school system. (Any proposed program of reform that did not provide for this should be considered suspect.) The angle *CBQ* in the model is what might be termed the "angle of reform." Many projects, especially when supported by massive injections of financial aid that might intensify the sense of urgency, fail because they make the angle of reform too acute.

There are two hypotheses that are central to this thesis of stages.

- There is a recognizable progression in the qualitative growth of most primary school systems, and one stage is a necessary prelude to the stage that follows. Except for stage I no stage can be skipped, although it is possible that, with better understanding, the stages can be shortened.
- Passage through the stages is limited by the level of general education of the teachers and by their level and type of professional training.

Changes in teacher education are a necessary, but not sufficient, cause of change in the stage of a system. Passage through the stages can also be limited by constraints of finance, material facilities, and politics. Yet planners most commonly overlook the more purely professional constraints.

Growth is, of course, a continuum, but in practice it is easier to consider it as a series of stages. Although the model in its present form applies directly only to primary (elementary) schools, most of the practical conclusions that can be drawn from it also apply to secondary schools. It remains to be seen whether any of the new technologies, such as mastery learning or the use of computers in schools, will enable a stage to be skipped. Also it is not clear whether such new technologies are economically or professionally feasible in a poor country.

Many of the school systems with which the Bank will be working will be at the upper levels of stage II or the lower levels of stage III. The transition from stage II to stage III and the progress through most of stage III is relatively simple, because teachers only have to be helped to do better the things they have been doing poorly. It is at the top level of stage III and the transition to stage IV that most of the projects fail.

At this stage teachers must accept new objectives, radical changes in attitude, and much more individual responsibility. This is hard for teachers educated and trained in very routine and authoritative systems. Curriculum changes from conventional arithmetic to the new mathematics and from the factual teaching of history and geography to the more complex teaching of social studies have proved difficult in some countries because the change involves moving from stage III to stage IV.

It is easier to get consensus on programs for raising school systems from stage II to stage III than on programs that call for teachers to shift from the top of stage III to stage IV. The faults in teaching and learning at stage II are so obvious that people with very different philosophies of education are likely to agree on the immediate steps to be taken. Because the move from stage III to stage IV means breaking with tradition and accepting new objectives and criteria of excellence, it can meet strong financial and political resistance.

Schooling at stage IV is always the most expensive. Elitist governments—South Africa is an extreme example—may think it politically dangerous to teach the mass of the people to think for themselves. Traditional governments may see the kind of thinking encouraged at stage IV as being disruptive of cultural, social, and religious values at their level of development. The role of the educator is limited here, and the position of the foreign adviser unusually delicate (Beeby 1980).

There may also be good educational reasons for delaying the transition to stage IV. When the level of skill of most teachers is too near the beginning of stage III, it is generally wiser to concentrate on helping them to do better the things they are already doing than to try to switch them to a radically different concept of education. At the same time if the administration of the schools is flexible enough, the most able teachers can be encouraged to venture into stage IV.

Qualitative Change in the Classroom

Five characteristics distinguish qualitative from quantitative change in classroom practice.

Consensus about Change

Quantitative changes are usually easy to define and measure, but there are frequently strong differences of

opinion on what constitutes improvement in quality. These differences are intensified by the difficulty of defining many qualitative objectives and of measuring progress toward them.

The best way to avoid confusion and misunderstanding in any new program for improving work in the classroom is to include representatives of all interested parties in the planning process from the beginning. One of the dangers of rushing operations is that there is no time to consult groups whose cooperation will be essential to the success of the program: teachers' organizations, inspectors (supervisors), teacher training institutions, and provincial and local authorities with some responsibility for schools.

It is not simply a matter of perfunctory consultation or passing on information. These groups must feel that they have contributed to the scheme, so share responsibility for it, and have an obligation to explain it to their members and the general public. In many countries the consumers of education—parents, students, and their prospective employers—have been able to kill or distort educational reforms if they feel the programs run counter to their traditional idea of what education really is. This suggestion, like some that follow, may seem almost too obvious to mention; yet these concepts are often ignored, with sad results, in many places.

Acceptance by Teachers

Qualitative changes in classroom practice will occur only when teachers understand them, feel secure with them, and accept them as their own. The most serious mistakes in planning changes in classroom practice occur in this area. There are several reasons why, in any new official program, some teachers do not sufficiently understand the new teaching methods and curricula that they are being asked to use.

The leap from the old practices to the new ones is often too wide for the average or below-average teacher to make in one step.

The time allowed—often only a week—to train classroom teachers is frequently too short when the changes to be made are big ones. The training, moreover, is usually too verbal and theoretical. Teachers, especially those with scant general education, do not learn new practices easily from lectures and pamphlets; they need to be able to observe the new methods being effectively practiced in a real classroom. If the practices to be learned are novel to the country and the whole program is unduly compressed, however, there are no classrooms in which to observe skilled teachers in action. This means that even the instructors who are sent from the center to introduce the innovations to the mass of the teachers may have no firsthand experience in the teaching methods and may have seen them demonstrated only in mini-lessons. They have little to transmit but theory and a few simple examples.

Another effect of overcompressing a pre-service training program is that in the outlying districts, classroom teachers, school inspectors, and teacher trainers all have to be introduced to the new methods at the same time—sometimes even in the same classes. In a hierarchical or authoritative school system this not only embarrasses the inspectors and teacher trainers, but it also deprives the teachers of the help of their acknowledged leaders and superiors at a critical juncture.

If a large innovative project is to succeed with the average and below-average teacher, the initial period of in-service training must be followed by systematic, continuing advisory services to teachers in their own classrooms. This must be done not for months, but gradually for several years. It is expensive and involves teams of visiting subject specialists as well as the normal inspectors. If a country cannot afford such a follow-up service to achieve a radical advance in teaching methods, it should consider a less ambitious form of change. Skimping in follow-up services is the most common and, in the end, the most wasteful reason that large projects fail.

Teacher training institutions should be the centers of in-service training. Yet the quality of teacher training, especially for the primary school teachers, is often low. Because of this situation training schools for primary teachers may not be used for the initial training for a new program, and such training is then undertaken by staff from training institutions for secondary teachers, who probably have no experience in primary schools. In far too many cases there are only weak links between training institutions for primary and secondary teachers as well as between primary and secondary schools. In most developing countries teacher training should receive the highest priority for aid and programs of reform. Follow-up work in the schools should also be a normal function of training institutions as soon as they are ready to undertake it.

The cycle of change in a school system is often too short, partly because of a rapid succession of ministers of education, each of whom is anxious to leave a mark and cherishes a misplaced faith in the power of a new syllabus to change classroom practice. Minor adjustments to any new syllabus are necessary within a year or two. But it takes at least ten years for a genuinely new syllabus, with a change of objectives, to become established throughout even a country of modest size. A cycle of ten years is the minimum, but one of about fifteen is usually better. In primary schools each teacher normally teaches almost every subject and can be overwhelmed with demands for change if the entire syllabus is altered at the same time. So a continuous reform of syllabuses and books is preferable, with syllabuses in different subjects being altered successively. This is not so necessary

in secondary schools, in which there are specialist teachers.

Teachers must be intellectually and emotionally secure if they are to venture from the established practice and the memorized textbook of state III to stage IV, in which students are encouraged to think for themselves and ask their own questions. There are several common causes for teachers to feel insecure with a new syllabus.

- Deficiencies in the teacher's own education and training.
- Lack of professional libraries and of the skill in using them. How can a teacher dare to encourage a class to ask questions if no one can find answers to the awkward ones? It is safer not to venture beyond the textbook.
- Necessity of teaching in a second language with which the teacher does not feel comfortable.
- Lack of strong and well-informed school principals, inspectors, and teacher training institutions.
- Lack of the moral support that comes from being a part of a broadly backed reform that has the support of both the ministry of education and the professional organization, as well as the understanding of the immediate community. A new program in education does best when it rides the crest of a wave of social and political change.
- Isolation of the classroom. Anything that breaks that isolation down, such as team teaching, the open classroom, and regular professional meetings with colleagues under good leadership can increase the sense of security.

But passive acceptance is not enough. Few real reforms in classroom practice are brought about by official fiat. Faced with a new syllabus and with nothing to support it, teachers regard it as something external to themselves and show a remarkable capacity to go on doing the same old things under a new name.

Teachers can be encouraged to accept new ideas and practices as their own by involving them through their professional organizations in the devising of the program and by giving them the freedom to make the practices their own by modifying them to suit their surroundings and adapting them to their personal styles. (There are difficulties in this for the administrator, as the next section will show.)

A teacher's faith in the new system tends to reach a low point a few weeks after returning full of enthusiasm, from the initial training course. The theory that has been learned and the few model lessons that have been given are not enough to meet the unforeseen problems of a full year's teaching. At this point an understanding principal and a visiting subject adviser are needed to help the teacher modify the new practices to each classroom. Unfortunately if the reforms have been introduced too fast, the principal may know no more about them than the teacher.

Variable Ability of Teachers

Teachers vary greatly in their capacity to make qualitative changes and in the speed at which they do it. This may appear to be a platitude that could be applied to any occupation. But there is one thing that distinguishes the teaching profession from most other forms of employment: apart from a relatively small number of administrative and advisory posts, it has no hierarchy in which individuals can be slotted according to their abilities. For any group of students the success or failure of a reform depends on the teacher who happens to have been assigned to them; unless there is some form of team teaching, the classroom is an island.

This peculiarity of the teaching profession creates a most complex administrative problem. How is an administrator to devise a system of control—for syllabuses, textbooks, examinations, supervision, and regulations—that leaves the able and imaginative teachers reasonably free to experiment and explore, while still giving the less able teachers the firm framework of support and instruction they need? No country, rich or poor, has found the complete answer to this question. The problem is especially difficult in developing countries in which the central control of education is traditionally authoritative.

Rate of Implementing Innovation

Qualitative changes in classroom practice almost never occur at the same rate throughout a country. This follows directly from the preceding statement, but there are additional reasons why different rates of progress are found among individual teachers as well as among schools and districts. If they are given freedom to maneuver, some local administrators, institutions, districts, and teachers will always outstrip the bulk of the profession in adopting the new official practices and even in experimenting with innovations of their own.

The way a country regards this ragged line of advance determines its policy for bringing about qualitative reform. If administrators accept this as a sign of healthy growth, they will base their strategy on these differences. They will seek ways to use the natural innovators to break new ground in their districts for the less able or more timid, but they must do this in such a way that the innovators are not themselves trapped within a new system and then given neither freedom nor encouragement to pioneer further.

This could lead to a two-phase strategy of qualitative reform. It is particularly applicable to a country (such as

Indonesia in 1970) in which there is a serious shortage of school textbooks, and in which the few existing ones are so poor that it would be absurd to reproduce them by the million, no matter how urgent the need. Most of the teachers are, say, at some level of stage III, and a few are ready to go on to stage IV. There is an immediate need for new and better books that can be produced rapidly. More sweeping reforms in curricula, textbooks, and teaching methods are necessary to improve quality significantly, but experience has shown this to be a very lengthy process. A two-stage strategy might operate in such a situation (Beeby 1979).

- *Phase I.* Make only such changes in the existing curriculum as are necessary to eliminate obvious faults and to help the mass of the teachers to do better the things they are already doing and with the same objectives. At the same time give freedom—and a little material aid—to the able and adventurous teachers to encourage them to interpret the curriculum more liberally and to experiment with new methods. Produce the first set of textbooks on this basis. It should be relatively simple to train teachers to use them. These books can be expected to last for some five years, which will give time for a new curriculum to be prepared and radically different books to be introduced when phase II becomes fully operative.
- *Phase II.* This phase must overlap with phase I and should be started as soon as phase I takes form. It will follow the pattern of phase I, except that alterations to the curriculum will be more drastic and will be reflected in trial textbooks produced in some economical form. These books will take longer to write, try out, and modify than the books in phase I. Likewise the inspectors, principals, teacher trainers, and a cadre of mobile tutors and advisers will have time to use the methods themselves before telling others how to use them. Since the new books will involve changes in the very objectives of teaching some subjects, the trials must be on a scale large enough to cover schools in districts that do not come under the immediate supervision of the original enthusiastic and skilled reformers. In addition to the schools in which the books are systematically tried, some of the better and more progressive schools in each district should be encouraged to experiment with at least some of the elements in the second-generation books. When the time seems fit to introduce all schools to the new curriculum, there will be model schools in every region in which teachers can see the system in operation.

It would be difficult to apply the two-phase technique in a very large country, such as Indonesia, which has a highly centralized school administration system. This is an additional reason for advocating a measure of decentralization that would stimulate initiative and a sense of commitment in individuals and institutions throughout the country. It is an expensive and time-consuming technique, but it might, in the long run, save great expenditures on books and training that later prove ineffective. Pilot projects, whether official or unofficial, form an essential part of a two-phase policy of introducing innovations.

Continuity of Change

Qualitative change in education is rarely linear or continuous. If qualitative change in classroom practice is a process of growth and not a matter of imprinting a complete new pattern on a whole school system at once, a project might be expected to follow some of the rules of organic growth: to flower, fruit, and die. This is, in fact, the natural life cycle of many projects, and there is no point in lamenting it. Spontaneous innovations in pedagogy have a habit of regressing toward the average when the bright souls who started them die or lose their fire, although they may also eventually come to exercise a powerful influence on practice. Even official programs of reform rarely retain their vigor for a long period. So determined reformers, no matter how extensive their official power, like a farmer, must plan for a succession of crops of new ideas and practices against the day when some of the old ones cease to grow. But this is impossible to do if all the initiative comes from the center.

In a developing country most of the educators who have studied and traveled overseas often are in the ministry of education or in institutions near the capital. It is natural that new ideas should originate in the center with official blessing, but, in the long run, this is not sufficient to maintain the liveliness of a school system. Changes of government or ministers, financial stringency, or sheer fatigue can sap the strength of a national campaign. If the impetus is not to be lost when the central drive flags, innovations must spring spontaneously from teachers or regional and local administrators.

The secret of a continuing, although not necessarily regular, advance lies in the symbiosis of the center and the periphery of an educational system: in the interplay of official programs and local or individual initiatives. These two kinds of innovations are subtly interdependent, and neglect of one will weaken both. Without overt evidence that the authorities encourage change, individual teachers and institutions are less likely to strike out boldly on their own. In return, while the official program is being developed, the pioneers can probe its weaknesses and give new meaning to its successes. When the program begins to lose its impetus, individual growing points will remain throughout the country to

sustain the spirit of change and suggest new lines of concerted advance as soon as conditions permit.

All these characteristics must be foreseen when the first plans are being made to improve the quality of classroom practice.

External Constraints on Change

In order to emphasize the role of the teacher in educational change, the external constraints on improving the quality of schooling have been neglected. These are well known to educational planners of all persuasions, but they still merit brief mention, if only to preclude the possibility of teachers being blamed for all failures to raise the quality of education systems. The most inspired teachers can have their efforts ruined by factors beyond their control.

Finance

Good education costs more than bad. (Beeby's Law, with acknowledgments to Gresham.) Admittedly an expensive school can, for a variety of reasons, be a bad one, but any attempt to improve the quality of a whole education system costs extra money, which is usually spent on books, equipment, materials, and services and always on in-service training.

It remains to be seen whether some new technology in education will break this unpalatable rule and reduce the cost of good education, but there is little sign of it as yet. It is difficult to judge the effectiveness of new technologies in conducting cheap mass education out of school, but, within the classroom, there is little chance of any combination of software and hardware replacing the teacher or making the job so simple that it can be carried on by less expensive monitors. (The sad experience of educational television in American Samoa bears this out.) Therefore the cost of technology must be added to the cost of teachers' salaries, which, especially in poor countries, is by far the biggest item of educational expenditure.

The cheapest—and poorest—form of schooling occurs in an institution at the bottom of stage I, with an ill-educated and poorly paid teacher, a blackboard, forty or fifty children, a few tattered books, and a syllabus that can be learned by heart. Every national advance from there toward the top of stage IV costs money.

Buildings

Quite good teaching, of the styles appropriate to stages II and III, can be done by competent teachers under great difficulties: in buildings that are stark, noisy, badly lit, scantily furnished (if at all), and not even completely waterproof. But the transition to stage IV demands much more than that, if only to store books and equipment and protect them from vandals and the weather. Some poor countries must use the same buildings for two or even three different schools and staffs in a day. This is tolerable at stages II and III but can be disruptive at stage IV. Unless there is extensive, safe storage, teachers have only the books and equipment they can carry to a lesson, and class projects have to be dismantled and taken away each day. The morale of enthusiastic teachers and students declines, the classroom stops being a place in which to linger, and the system easily drifts back to rote learning from textbook and dictated notes.

Books and Equipment

Each step a school system takes from stage I to stage IV creates a new demand for books, writing materials, and school equipment. The need for these materials increases dramatically during the transition from the top of stage III to stage IV. If the links between symbols and their meaning are to be strengthened, children must have equipment and materials to reinforce the connections between the words and numerals they are learning and the practical things they represent. If students are to be encouraged to think for themselves and to ask questions in class, both they and their teachers must have access to libraries. Outside the towns they are likely to find one only in the school. The sciences cannot be learned simply from a textbook, yet laboratories and workshops are expensive to build and maintain.

Administration

The best of projects can fail through poor coordination in the ministry of education or through a breakdown of communication with distant provinces or districts. Lack of cooperation, not to mention antagonism, between divisions in the ministry can be fatal to a project.

Not infrequently there is tension between a unit that develops curricula and the divisions that control the day-to-day work and inspection of the schools. Equally as serious is the failure to include the examination division at the very beginning when a reform is being planned. In the long run the people who set the external examinations have more influence on what goes on in the classroom than the people who write the curricula or control the schools.

In a very large and scattered school system with highly centralized administration the lines of communication with outlying provinces and districts are often ineffectual. They are strong enough to check regional and local growth, but not strong enough to

stimulate, feed, and control it. Regional administrators, district inspectors of schools, and teacher training institutions (particularly for primary teachers) can become cut off from the mainstream of educational thinking.

Primary school inspectors or supervisors are the ministry's only continuing professional link with the classroom teacher, and yet they are often the most isolated people in the whole system of control. Because of their isolation, they tend to be conservative and bound to routine and are consequently ignored by the reformer who is impatient for quick change. The same is true of the institutions that train primary teachers. Yet often the mobile teams who introduced the innovations have departed, it is the inspectors and the training institutions that must provide the follow-up program. Their work can be coordinated more effectively by a regional representative of the ministry, but to do that, the regional staffer must have sufficient power. Delegation of control, however, does not come easily to a government intent on establishing or maintaining national unity.

Conditions of Service for Teachers

Any change in classroom practice necessarily involves teachers in a great deal of additional work, especially in the first year or two. Whether they are willing to make the extra effort depends on their morale and conditions of work. Poor housing conditions, which are common in rural areas, can seriously affect morale. Low salaries will make it necessary to take on a second job, which will absorb time and energy that should go into the arduous task of planning new courses and testing the results on their students. Nothing destroys morale more thoroughly, however, than requests and complaints to the ministry that go unanswered, salaries that arrive late, injustices and hard cases that are ignored, and a growing conviction that no one at the center really cares. This is felt particularly strongly in rural areas. The brightest ideas and the best plans can bog down in a morass of discontent over apparent trifles.

Conclusions

This would be a cheerless note on which to end. Since my first professional contacts with education in developing countries in 1945, however, there has been enough real progress to justify mild optimism in anyone who is not expecting miracles.

Many developing countries have made admirable efforts to provide more school places for their children. If the progress in improving the quality of their schools has been slower and more checkered than had been hoped, that is mostly because the job is far more difficult than had been naively imagined. Disappointment about unreal hopes can blind one to the progress that has occurred.

In the past forty years some countries have implemented improvements in quality that are creditable when seen against the backdrop of the four stages of growth. There are no schools as poor as some were back then, and the average teacher has moved up a full stage on the scale. The best of the teachers already have some vision of what a school at stage IV would be like, and a handful of them run classrooms in which some of the qualities of that stage are already appearing. Some of the more advanced countries, such as Malaysia, have done even better than this. Real progress in improving the quality of education on a national scale is so slow in any country, rich or poor, that one has to stay around a long time to see it with the naked eye.

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5

Lessons from Bank Experience

The World Bank and its borrowers are increasingly concerned about the quality of education. Enrollments are rising quickly, and the variety and sophistication of cognitive skills expected to be transferred through formal education are rising in parallel fashion, but the capital available per student is not. The result is an increasing demand for lending for education to ameliorate problems of educational quality.

For the past five years the Bank has embarked on a series of research projects on educational quality. The products have appeared in the academic and professional literature and, in various forms, have been distributed and discussed with operational staff and borrowers. But the diffusion and dissemination has not been organized or coordinated.

The Bank has also broadened its experience in improving the quality of education through its lending program. Projects considered unusual a decade ago are now commonplace, such as producing and distributing textbooks, manufacturing school equipment and facilities, and strengthening educational administration. Likewise increased attention has been given to the problems of school quality in economic and sector work.

The seminar on which this volume is based, was designed to give both operational and research staff a chance to reflect on what has been learned. More than being a technical summary of the Bank's research, the seminar delved into policy issues, such as school management, the economics of planning curriculum objectives, and the tradeoffs between school quality and school expansion. The seminar provided an opportunity for scholars with theoretical experience from both outside and inside the Bank to work alongside operations staff with experience in managing investments in educational quality. There were twelve sessions in the two-day seminar; four focused on research problems and eight on operational problems. Sessions that focused on research issues included: school quality and economic efficiency, the retention of cognitive skills and literacy, socioeconomic status and academic achievement, and the distribution of school quality within countries.

Operational sessions included: the preparation of teachers, the administration of school systems, promotion and repetition practices, examinations and selection policies, electronic media, time on task, production and distribution of textbooks, and prevocational workshop subjects. Reports from the eight operational sessions follow.

Administration of School Systems

Session chairman: Abdelwahed Zhiri
Participants: Mats Hultin, Douglas Keare, Sherry Keith, William Loxley, James McCabe, and Delia Pitts

As the education sector worldwide has grown during recent years, the problems of educational administration have become more complex. Yet Bank research has found that the greatest weakness of educational systems in developing countries is their management system.

In the industrialized countries management has improved, and schools provide numerous services, such as health care, libraries, compensatory education, occupational counseling, and athletics. All over the world there are more students with special needs, more subjects to be taught, and more depth required in the teaching of those subjects.

Yet the governments of many developing countries do

not have the necessary resources to maintain, let alone increase, the services provided by their education systems. The rate of growth in real per capita government expenditures on education fell in many countries between 1972 and 1979. The rate of growth fell in Guatemala by 91 percent, in Brazil by 72 percent, in Syria by 42 percent, in Zambia by 50 percent, and in Malawi by 24 percent. It is therefore necessary to find ways to make the education sector more efficient with the same amount of resources.

Research Problems

The state of the art regarding educational management is weak. In some cases there are unclear objectives, inefficient managers, inappropriate methods of selecting and assisting managers, and either insufficient or inappropriate incentives. Moreover many previous studies of educational administration have been too superficial to provide much guidance.

Decentralization by itself is not the best way to solve the problems of educational management. The "best" solution will be different for each country. The appropriate degree of centralization or decentralization varies with institutional structure, the size of a country, and the level of development of its economy. It also varies with the quality of the personnel that implements decisions at each level. In addition the political consequences of administrative changes, such as teacher strikes in Colombia, must be better foreseen by the Bank.

Recommendations

The World Bank should

- Analyze each administrative process in education step by step and level by level
- Support the kind of research that could contribute to better educational management; this research should clarify issues, define objectives, and evaluate experiences.
- Make better analyses of the prerequisites to sound education management.
- Invest more effort in participatory management, although the area is complex
- Conduct comparisons of administrative systems in its normal sector work.

Examination and Selection Policies

Session chairman: Ralph Harbison
Presenters: Anthony Somerset and Benjamin Makau
Participants: Albert Aime, Richard Johanson, Robert McMeekin, Abdun Noor, George Psacharopoulos, Jee Peng Tan, Hans Thias, Jacob Van Lutsenburg Maas, and Lawrence Wolff

The term "examinations" refers to externally set standard tests for selection or diagnosis that are administered to students in reasonably large areas. These areas could constitute entire nations, parts of a nation, a state, or a province. Tests designed by teachers for classes or individual schools are not included in this definition.

Central Recommendations

Examinations systems should be integral elements in the highly interactive set of inputs to the quality of schooling, for several reasons. First, if properly designed and properly managed, the examinations can exert powerful positive influence to improve other key variables of school quality, such as curricula and supporting materials, teachers' classroom activity, and school administration. In addition a measure of what pupils have learned is the best overall indicator of educational product. Whatever else examinations may accomplish, they provide information on what has been learned, which can be used to improve educational planning and management. Finally examination systems, because of their incentives, are among the most powerful instruments for improving school quality and management. Compared with the other inputs to school quality, examinations are relatively cheap and can have a pervasive effect.

Examination and testing systems should be evaluated on an equal basis with other inputs to school quality. This has several implications. In sector work the Bank should automatically examine a nation's system for measuring learning outcomes and for effectively using the results. When the Bank finds deficiences in how information on learning outcomes is obtained or used, it should then consider how these deficiencies might be remedied. As with other inputs to school quality, the Bank should be ready to make the necessary investments.

Subsidiary Recommendations

The first priority is to make the examination as effective as possible. This means orienting the systems toward measuring the basic and complex intellectual skills students need to understand and control their environment. It means orienting them toward widely agreed and practical educational objectives. Even where examination systems already exist, there is often much that could be improved.

An examination system that is not somewhat autonomous from direct control by government should be assessed with special skepticism. Independence from political pressure and protection from educational bureaucracies is a prerequisite to the successful use of examinations.

Examination systems should have a research unit: a nucleus of highly trained professionals, who analyze the wealth of data generated by examination systems and propose ways to improve both the quality and management of education. Often the first step toward converting exams into true inputs of school quality is to graft this research capacity onto an examination unit whose principal function is selection and certification.

Examinations bodies, like other inputs of school quality, must enjoy public acceptance. This suggests that they should have a reasonable capacity for public relations and public education so that the uses of examinations can be fully explained and the results made available for public scrutiny.

It takes a long time to develop examinations, especially when starting from scratch. This is even truer when the prominent objectives are to improve the quality and management of schools. Thus, support for examinations development should be planned for a decade or more.

Promotion and Repetition Policies

Session chairman: Aurelio Cespedes
Presenter: Birger Fredriksen
Participants: Gunnar Berlin, Hon-Chan Chai, Richard Durstine, Barbara Searle, and Eric Swanson

The problem of students repeating grades and the accompanying wastage is critical in most developing countries. A Unesco survey (1980) noted that 15 percent of the students enrolled in primary education in developing countries were repeaters. This figure was 12 percent in Latin America, 16 percent in Africa, and 17 percent in Asia.

The level of repetition varies greatly among different cultural settings. For example in the twenty French-speaking countries included in the survey the rate of repetition ranged between 16 and 40 percent. Arabic-speaking countries had a similar range in repetition rates: Sudan had the lowest figure, 3 percent, which reflected automatic promotion, while Morocco had 28 percent, which indicated repetition practices. English-speaking countries, meanwhile, had a 10 percent repetition rate and Spanish-speaking countries had a rate of 10 to 11 percent. French-speaking countries had the highest percentage of repeaters in the upper primary school grades (four through six), while English-speaking and Latin American countries had the highest rate of repeaters in grades one through three.

Analyzing the Effects of Repetition

The effect of repetition on the internal efficiency of school systems is normally analyzed by student flow models. The results derived from such models are affected by two types of errors. The first results from the low quality of the education statistics available in many countries: overreporting of first grade enrollments, incorrect distinction between new entrants and repeaters, and yearly variation in the coverage of data.

The other type of error results from the assumption that pupils behave homogeneously: that pupils enrolled in a given grade in a given school year have the same propensity to be promoted, to repeat the same grade, or to drop out, regardless of their academic history. This assumption is required because of the lack of statistics on how previous academic history affects present behavior. But working against this assumption is the fact that many developing countries have limits as to how many times a pupil may repeat.

The five most common types of limits on repetitions are shown in Table 5-1, and models for analyzing the effects of these limits are developed in Fredriksen (1983).

Table 5-1. *Restrictions on the Repetition of Grades in Ninety-Two Countries*

Restriction	*Number of countries*	
	Primary education	*Secondary education*
Promotion is automatic, that is, repetition is not permitted in any grade.	10	7
Certain grades may be repeated but not others.	12	4
All grades may be repeated a limited number of times.	21	35
The number of repetitions permitted during a given cycle is restricted, but there are no further restrictions on the number of repetitions permitted in any given grade.	7	9
The number of repetitions permitted in any given grade, as well as during the cycle, is restricted.	12	13
Total	62	68

Source: Unesco (1980), Tables 7.1 and 7.2.

Repetition and Wastage

Repetition is wasteful. If 15 percent of the students repeat at least one grade, then the educational systems would need to spend seven years to produce a sixth grade graduate. The efficiency of the rural education systems of certain countries is so low that it requires twelve to twenty student years to produce a primary school graduate, which is two or three times a standard primary school cycle of six years.

There are economic and educational implications of this economic waste caused by the repetition and promotion practices in developing countries. Repetition limits the number of students that a given system can take in, increases the cost of education, and causes resources to be distributed inequitably.

Educational Effects

There is evidence that elementary school repetition is associated with the students' sense of security and their early experiences of success and failure (International Bureau of Education 1971), causes both achievement and intelligence scores to deteriorate in the long term (Goodlad 1954), and increases repetition at the secondary level (Carnoy and Thias 1974).

The Unesco survey shows that of the ninety-two countries that provided information on primary education, sixty-two reported having regulations on promotion and some kind of restrictions on grade repetition.

There are various assumptions and arguments for and against the practice of repetition in developing countries. Countries that favor repetition do so based on three assumptions.

- Most pupils can learn the curriculum assigned to each grade in the prescribed time. In Latin America, for instance, Colombia, Guatemala, and Peru expect that first graders should learn how to read and write (*de corrido*) during the first year of school. Factors that determine academic achievement, such as the nature of the students, their socioeconomic backgrounds, and most important, the level of classroom quality to which they are exposed, were not considered.
- The best remedy for pupils who fail to reach the minimum standard set for a given grade is to spend more time in that grade.
- It is possible, through school-designed tests and teachers' judgment, to single out students who have acquired the minimum attainment necessary to progress to the next grade.

Some countries, such as Singapore, Tunisia, and Dominican Republic, which have promoted students automatically in the past have recently adopted policies on repetition. The practice of repetition in these cases is considered a remedy for inadequate academic achievement.

The arguments against repetition, and thus in favor of automatic promotion, have been discussed in the literature (Brown 1966, Jackson 1975, Goodlad 1954).

- Student characteristics (age, degree of motivation, and state of nutrition and health) and supply factors (teachers, learning materials, and school facilities) should be considered in school decisions concerning promotion.
- In most developing countries there are no guidelines or examination standards; hence, the validity of tests given by classroom teachers is questionable.
- External school factors, including the family background, are important variables influencing repetition. Repetition can result in the fact that families are unable to properly feed their children.

Structural problems may also cause repetition such as: poor quality teachers, too few textbooks and other relevant learning materials, inadequate guidelines for assessing student learning, too few national examination systems, and too few well-trained education managers and school directors.

General Recommendations

The participants agreed with the general conclusions of Haddad (1979) that although promotion seems to be more desirable than retention or repetition, the real issue is to prevent failure. The main assumption is that the Bank needs to work both with borrowers that practice repetition and with those that have automatic promotion. The Bank should develop the following remedial actions in close coordination with developing countries.

- Help borrowers develop adequate guidelines for collecting, processing, and disseminating relevant statistics on repetition and promotion so that the dimension of the problem can be better known by all parties concerned.
- Encourage some developing countries to review their objectives for primary education so that expectations may be adjusted to the prevailing local conditions, curricula, school calendar, time schedules, and other relevant parameters.
- Encourage borrowers to document teachers' attitudes toward slow learners, to develop in-service training for teachers in the use of student achievement variables and student evaluation systems, and to provide special summer courses for slow learners and for students who would otherwise repeat a given grade.
- Document and research the effect of factors related to family background, particularly socioeconomic conditions. Poorly nourished children, who are the

main candidates for grade repetition in developing countries, ought to constitute a significant variable in any investigation concerning school repetition. Priority for examining and correcting these conditions should be given to countries in which repetition practices are based solely upon results of achievement tests.

- Study one or two countries that had automatic promotion in the past and have recently adopted a policy on repetition. Among those which might be considered are Singapore, Tunisia, and the Dominican Republic.
- Encourage the regular exchange of ideas among education staff in research and operations to facilitate follow-up on suggestions and ideas, such as those presented in this section, which might be important to both the Bank and its borrowers.

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Teacher Training

Session chairman: Frank Farner
Presenter: Mae Chu Chang
Participants: Victor Billeh, Shigenari Futagami, Himelda Martinez, Andre Salmon, and Mulugeta Wodajo

There appears to be a minimum level of basic education needed if training for primary school teachers is to have any effect on student achievement. Beyond this threshold there appear to be diminishing returns on the degree to which teacher training can be expected to be effective. This threshold varies from country to country and also changes with time; what is considered to be a minimum educational requirement for primary school teachers will probably be too low ten years from now. This process is a normal part of economic and social change and should not be treated as unusual. When there are not enough teachers to meet enrollment demands, however, village adults who meet the educational threshold as teachers should be given a chance to teach, as was done in the Pakistan and Bangladesh Primary Projects.

Policy Recommendations

In-service education should be tied to training a specific set of skills or a specific reform in education, such as implementing a new curriculum or introducing new textbooks. For reasons of cost in-service training should not be offered for its own sake or in isolation from other education inputs. Recertification, inspection systems, or enhanced supervision should be considered a necessary part of in-service education.

Teacher salaries should be on the same scale as those of other civil servants, but teachers of specialized subjects should be paid a supplemental allowance according to supply and demand. For example in Jordan science teachers receive a rarity allowance in addition to the basic pay, which gives them higher salaries than history teachers.

Formation of teacher resource centers where teachers come to share new ideas and receive some form of in-service education on a voluntary basis should be encouraged. In Malaysia, for example, four Education Resource Centers have been established and have been very effective.

Areas for More Research

The following questions are pertinent for further research.

- Which teaching styles have the greatest effect on achievement? In what particular cultural settings are they effective?
- Should there be merit increases for teachers in addition to seniority raises? What effect would merit increases have on teacher performance and subsequently on student achievement?
- In each country what is the minimum level of basic education required for primary teachers in light of the demand for particular levels of complexity in curriculum content?
- What is the relative effectiveness of a fully trained urban teacher sent to the countryside versus an

assistant teacher who is a local rural person with less training?

- Is a local rural teacher likely to be more motivated than a teacher from an urban area or a different rural area?
- What is the relation between age or sex of the teacher and student achievement in a particular cultural setting?
- What are the criteria for determining whether the salaries of teachers in a country are too high or too low as a percentage of the government budget, GNP, or the demographic profile? Is there another, more logical comparison?

Time on Task

Session chairman: Sherry Keith
Presenter: Henry Levin
Participants: Hon-Chan Chai, Richard Durstine, Ralph Harbison, Mats Hultin, and Abdun Noor

Henry Levin's presentation helped to identify the conceptual problems associated with the use of time as a factor affecting educational quality outcomes. He stressed the intuitive appeal of time-on-task because of its notion that more time spent learning would lead to higher achievement. His review of the existing research literature did not fully confirm this view, however. The knowledge to date on the concept of time suggests that total time spent in school may not be a useful indicator because a variable proportion of that time is "noninstructional," that is, devoted to lunch recess, interruptions, and so forth and that students may or may not be actually learning, even during the instructional time.

Engaged time has been studied through classroom observational methods, mostly in North America. The results of such studies suggest that students use many techniques to appear as though they are learning during instruction, although they may actually not be.

There is a conceptual model for analyzing the relation of time and learning and the interaction of time with other critical factors that affect the learning process. This model can be summarized as:

$$[\text{Student capacity}] \times [\text{Student effort}] \times [\text{Time}] \times [\text{Quality of Resources}]$$

Recommendations

There is very little systematic comparative information regarding time and schooling in developing countries. Thus the Bank should

- Develop a simple set of cross-national indicators of time, such as hours in the school day and days in the school year, that could be made available regularly to project officers and others
- Do more research on the use of time in the classroom in various developing countries
- Review the best way to introduce and sequence subjects within the curriculum, minimum learning thresholds, and the problems associated with instituting greater selectivity in the curriculum.
- Study the costs associated with manipulating school time.

Prevocational Subjects

Session chairman: Jacob Van Lutsenburg Maas
Presenter: William Loxley
Participants: Mae Chu Chang, Richard Johanson, Himelda Martinez, George Psacharopoulos, André Salmon, Lennart Swahn, Mulugeta Wodajo, and Abdelwahed Zhiri

The topic of prevocational subjects has been controversial, in part because of confusion over definitions and of what may be called the "misimplementation" of these ideas in Bank-financed projects. The sources of this confusion need to be confronted before any recommendations for either research or for policy can be made.

Conceptual Problems

Prevocational subjects in secondary education have been seen as part of a process of "curriculum diversification," which would give a more "practical" emphasis to teaching. On reflection, however, it is becoming clearer that these key ideas or terms have actually meant different things to different audiences in various countries and regions. Sometimes they have meant different things within countries and even among Bank staff.

One way to grasp these differences is to conceive of a curricular spectrum rather than trying to arrive at the "correct" definition. This spectrum is shown with some related variables in Table 5-2. At one extreme is vocational training; at the other is general education. Arrayed in between the extremes are Models I and II and a third model. They are arranged in order of their varying intensities for allocating specialized teaching time and physical resources to the task of "practical teaching." Models I and II are borrowed directly from the curriculum typology used in the DISCUS (Diversification of Secondary Curriculum Study). Model I provides prevocational subjects in a general education curricu-

Table 5-2. ***Models of Curriculum Diversification for Prevocational Subjects***

General education	*"Missing model"*	*Model I*	*Model II*	*Vocational training*
	No subjects or tracks are added to the curricula. Practical knowledge and skills are taught and applied through general subjects, in science and other core subjects.	Prevocational subjects are added to the general education curricula of high schools.	Prevocational tracks are offered in comprehensive high schools.	
		About 25 percent of class time is given to prevocational subjects.	About 50 percent of class time is given to prevocational subjects. Content is almost "semivocational."	
	This model has not been adopted in Bank-financed projects.	Example: Tanzania	Example: Colombia	

lum. Model II provides prevocational tracks, which are much more time-consuming and amount to a semivocational training conducted in a comprehensive school. There should also be a third model, a so-called "missing model," which was not identified in DISCUS.

Curriculum reform under the "missing model" would not require extra subjects to be added to the school timetable as does Model I. Instead it would require most core subjects to be taught with a practical or applied emphasis. This would be especially true in science but would also apply to the teaching of mathematics, language, and social studies.

The goal of giving a practical bias to the core subjects would be to learn application skills, in contrast to isolated bits of factual knowledge abstracted from the "real world." It would bring relatively common technology into the classroom and laboratory, yet it would not mean the procurement of heavy specialized machinery (which in too many instances has typified the Model II and even Model I curriculum reforms).

Misimplementation

The "missing" model is missing because it has apparently never been consciously adopted and supported in a project financed by the Bank. It is not clear whether this has been because of Bank-specific tendencies such as the need to find procurable items to finance (the more expensive the item, the less time-consuming the procurement might be, and the faster the disbursement) or the urge to show a direct "manpower justification" even for general secondary education. These tendencies may have artificially pushed the curricula sponsored through World Bank projects toward the vocational end of the spectrum. They may also have encouraged the procurement of heavier and more expensive teaching equipment than was appropriate.

It is important to evaluate the cost-effectiveness of each model represented in DISCUS, which implies having access to very thorough cost data. Student attitudes as well as cognitive and labor market performance should be measured. The following questions should be addressed in the data analysis.

- Which model of prevocational subjects is most cost effective, and why?
- Does time spent in a prevocational track (Model II) or in a prevocational subject (Model I) reduce chances for university entry? The underlying assumption here is that instructional time is a scarce resource, and therefore there is a tradeoff between university access and prevocational education. In other words does prevocational education reduce academic subject achievement or standards? Or, does prevocational education tend to reduce the upward social mobility of students from low-income backgrounds? Since it is sometimes argued that prevocational education should discourage students from continuing into university, the DISCUS study should determine whether prevocational graduates have a greater rate of failure in the university than graduates who had more traditional curricula.
- Where should prevocational education occur—in lower secondary schools, in upper secondary

schools, or in specialized programs outside of school?

- What is the best age for prevocational education?

A General Proposition

There are general conditions or criteria under which Model I and Model II prevocational education might be most successfully implemented. As a general rule of thumb these models of diversification would be more feasible where there is a high rate of enrollment in secondary schools. No actual threshold enrollment rate could be established, but it is now clear that where the enrollment rate is low, secondary school students will not be motivated to narrow their career horizons to any particular prevocational subject or track while they are still studying. Instead they will tend to devote their efforts to core subjects that will keep their options open once they embark seriously on their job search.

The criterion of affordability is another test of whether public authorities should establish prevocational programs. It has been assumed that prevocational education using Models I and II would be more costly than general education. One attraction of the "missing model" is precisely its lower investment and operating costs.

The Production and Distribution of Textbooks

Session chairman: Laurence Wolff
Presenter: Philip Altbach
Participants: Albert Aime, Frank Farner, Douglas Keare, Eric Swanson, and Hans Thias

Textbooks are a key element of many Bank education programs and have a marked effect on educational quality in developing nations. This assumption is supported by the available literature and by the Bank's experience. Thus the provision of textbooks should remain a key priority.

Although the Bank has built up considerable expertise in designing and implementing textbook programs, there is little available guidance concerning the general guidelines on developing textbook programs. Thus each project requires careful attention to the specific problems and issues in the borrowing nation. Nevertheless several general points can be made concerning textbook development projects and the role of textbooks in developing societies:

- A pragmatic approach to textbook development is required precisely because there are few general rules that can be applied.
- Textbooks are part of a broader system of publishing and knowledge dissemination in all countries, and that system must be considered when designing textbook projects.
- Textbook programs must be integrated into curriculum projects and other aspects of educational development.
- A multi-stage approach to textbook development seems to be most effective. That is, it will take about a decade to develop textbooks, and at least two stages are involved. In the first stage books are provided promptly, even if they are not dramatically different in content from those already in use. In the second stage new textbooks with new approaches are integrated in the curricula, and other desired changes are made.
- Books that related to school curricula but are not necessarily textbooks should be integrated into textbook projects. The development of school libraries, of reading materials for newly literate students and of supplementary books should all be a part of a comprehensive textbook project.

The Publishing System

World Bank projects often have a substantial effect on a national book industry: they have the potential to contribute significantly to the development of that industry or to retard its growth. Because of the sheer number of books published, textbooks have traditionally been an important part of a private sector publishing industry and can contribute to the development of economic health and infrastructure.

Multinational publishers, however, have had a key role in textbook development in many developing nations, particularly in Africa, and this role has sometimes been controversial. On the one hand multinational publishers can participate constructively in textbook development and may even be essential in countries in which a significant publishing industry does not exist. On the other hand the multinationals have their own economic interests, and these may not always work to the advantage of the developing countries. In considering any textbook project, the Bank must consider the effect of the project not only on the educational system but also on the development and infrastructure of the national publishing industry.

Integrating Textbook Development with Other Innovations

Textbook projects have often been integrated into curricular developments and educational innovations. It is necessary in all cases to ensure that this integration is a key part of the design and implementation of a text-

book project, even if this means that the ultimate goals of the project take longer than normal to achieve results. In addition the development of a textbook must be accompanied by the creation of appropriate teachers' workbooks and especially in-service modules so that the text can be quickly integrated into the educational program of the school.

Higher-level staff must be trained in publishing, editing, and textbook writing. This may involve regional training centers or secondment to established publishers. Textbook storage facilities and minilibraries are also essential. Funds and appropriate expertise must be built into any textbook project to ensure that this integration can occur. In smaller countries with limited expertise, however, it is important to limit curricular and textbook innovation to that which can be realistically accomplished and to adopt existing material wherever appropriate.

A Multi-Stage Approach

C. E. Beeby's presentation (chapter 4) and the experience of the Bank's textbook projects have shown that it requires a rather long lead time to develop textbooks, and this must be incorporated into project design. In most instances a textbook project should start out with the development and production of a book that reflects established curricular patterns. Such a book should not require significant innovations from teachers and should be placed in the hands of students relatively quickly to satisfy immediate demands. The greatest thrust should be placed on creating innovative textbooks over a long period. Thus books can be adequately tested as part of the development process, ancillary materials can be developed and coordinated, and curriculum authorities can be involved in text development. By the time these revisions are ready to be published, the first editions will have worn out and will need to be replaced anyway. Thus Bank lending policies might well be adjusted for a longer-term effort, or it may be necessary for two loan programs to be involved in each text project.

Participation

The development of quality textbooks requires advice and input from a variety of sources, so appropriate participation should be built into textbook projects. The participation of curricular experts has already been mentioned, as has the involvement of the local publishing industry. Teacher representatives, local supervisors, and appropriate ministry officials should also be involved. Those who will design, produce, and use the books must also participate in the process of creating and producing them.

Textbooks, Libraries, and Literacy

Textbooks are but one part of a broadly conceived learning and literacy program for developing countries. Wherever appropriate, textbooks should be accompanied by supplementary reading materials for the schools. School libraries should be encouraged, and other books covering the same subjects as the text should normally be part of the text project. In addition attention should be given to the broader development of library resources to maintain literacy and an interest in learning in the society.

Financing Textbooks

Textbooks can be financed in many ways; no single means for textbook finance is preferred aside from a general commitment to provide free textbooks in the long run. There is a concern, however, about the funding of textbooks once Bank assistance ends. In some instances it may be appropriate for students to purchase books or for special education taxes to be imposed. But costly covers, illustrations, and other items should be kept to the minimum necessary to meet educational goals. The overriding concern is to ensure that textbooks remain a priority of the educational authorities and that funds be maintained to replenish textbooks once Bank-assisted texts are no longer in use.

A Research Agenda

Although the data show that textbooks have a positive effect on educational quality and results, additional research should be done in this area. Wider research results are needed concerning the nature of textbook contributions to educational quality. In particular how many textbooks will have the maximum effect, and where do diminishing returns enter? Do texts for one level of the educational system have a greater effect than for others?

The Bank now has a wealth of practical experience in textbook programs. It would be very helpful to have appropriate case studies on these experiences. The description and analysis of some typical projects would help to provide guidelines for future involvement. Research on the experience of textbook programs implemented by other aid agencies or by such indigenous organizations as the National Book Trust in India or the Dewan Bahasa dan Pustaka in Malaysia would also be helpful.

The Use of Electronic Media

Session chairman: Barbara Searle
Co-chairman: Dean Jamison
Participants: Victor Billeh, Gunnar Berlin, Aurelio Cespedes, Shigenari Futagami, Delia Pitts

"Media" is a shorthand label for "the programs that are transmitted by the media." This point is important because radio and television only deliver the programs. The effectiveness of a mediated program (one delivered by an electronic medium) depends far more on the quality and appropriateness of the "software" than on the characteristics of the medium itself. Nevertheless the characteristics of the medium may limit or enhance the effectiveness of the program in reaching its objectives. Thus the use of media (particularly radio) can be examined in several instructional contexts.

Direct Teaching in Schools

One or two decades ago there were high hopes that lessons transmitted to students in schools by radio or television represented a means to increase access to schools while maintaining quality at no extra cost. This would be accomplished because teachers would be able to teach larger groups of students (since the media would transmit much of the instruction) or less-qualified teachers, usually monitors without formal qualifications, would be able to run classrooms in which students were taught by the media. During the 1970s many experiments were conducted to test this concept. These evaluations, which were well conceived and adequately funded, produced some valuable conclusions.

- Instructional programs delivered through media can teach children. Some subjects are taught better than others, and radio and television impose different constraints on the types of instruction that can be transmitted, but children do learn.
- It is far more difficult to develop effective instructional materials than anyone had anticipated. It is time-consuming and expensive because it involves analysis of the curricula, careful specification of learning outcomes, formative evaluation, and the development of instructional strategies particularly suited to the medium. In some countries in which the level of media sophistication is high, production quality must also be high.
- The (apparently reasonable) expectation that money could be saved on teacher salaries has not been met. In projects that have tried to use higher student-teacher ratios or underqualified teachers, the instructors have forced the schools, through strikes and other means, to raise salaries or lower class sizes. Thus the goal of cost reductions has not been achieved. In fact since the production of software has turned out to be expensive, programs using media are almost always more expensive than comparable programs without media. Some media experiments have improved achievement levels, however, rather than simply substituting for teachers. The question of whether the improvement in quality is worth the cost is, of course, a value judgment that must be made in each case.
- The experience developed in one country can be transferred to other countries. The "Radio Math" lessons developed in Nicaragua have been translated into Thai and are teaching Thai children as effectively as they taught Nicaraguan children.

Although there has been much experimentation, few countries have adopted in-school direct teaching nationwide, although Thailand is considering this with the math lessons.

Direct Teaching Out of School

Many experiments have used lessons delivered by radio or television in conjunction with a correspondence course. Often such courses use community residents or underqualified teachers as monitors to lead tutoring sessions. Several of these have led to permanently established programs, such as the Malawi Correspondence College. Although the medium does not carry the full burden of instruction in these cases, it paces learning and can explain difficult concepts. Such systems are particularly likely to become established where examinations can be taken outside the classroom.

In-Service Teacher Training

The use of radio for in-service training of teachers has several advantages over alternative methods, particularly for teachers in rural areas. In areas in which teachers are widely dispersed, it substantially reduces transport costs. The programs can reach teachers in their homes and schools, and they can provide support and training for long periods. Radio programs, in contrast to printed material, can model teaching behavior for teachers. Finally radio programs can keep teachers up to date about new developments and help build their security as sources of information for students. Radio lessons must be followed up with personal contact with supervisors and occasional face-to-face teaching sessions, however, so that teachers and programmers alike can get feedback.

Building Support for Educational Change

Radio and television programs aimed at the population at large are a powerful tool for building support for

educational change. Programs can provide parents with reliable information about what schools are expected to do and what their children are expected to learn. This in turn can create expectations to which schools must respond. Programs can also be used to build support for the policies and goals of the educational system. Authorities can pave the way for important reforms by explaining the changes in advance.

Observations

- Media-based instructional programs have a comparative advantage in several special circumstances, including reaching very geographically dispersed populations (for example, the Universities of the West Indies and the South Pacific); reaching very large populations, where the cost of developing programs is small for each student (for example, the TV University of China); and teaching specialized subjects for which teachers are inadequately prepared (particularly second or foreign languages).
- The effectiveness of correspondence programs can often be improved by adding lessons delivered by radio or television.
- Radio has not been adequately explored as a way to provide on-going in-service instruction to teachers.
- The potential for using media to build community support for educational reforms and for educating parents about what they should expect from schools has scarcely been exploited.

Recommendations

The World Bank should give more emphasis through its lending program to the use of media, particularly radio, for educational purposes where analysis of the context suggests it has a comparative advantage. In addition it should explore ways to increase cross-fertilization among countries so that educators and planners can benefit from the experiences already gained in other countries by exchanging methods, ideas, and even programs.

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As these schools systems have grown, however, attention has been shifting toward the quality and value of the education being received. Evidence has been slowly accumulating to suggest that the quality of education—availability of reading material, a well-trained teacher, an adequate classroom—is as important to prospects for economic development as is the quantity of education obtained.

The staff of the World Bank's education sector held a retreat to consider this evidence and to reflect on the strategies for improving the quality of education in the developing countries. This volume reports the evidence presented and the strategies considered. The papers are some of the first to address this topic. They fall into two parts: the first relates to the economic growth that might result from expenditures on the quality of education; the second concerns the best way to implement changes intended to improve the quality of education.

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